

Conceptual Database Design



Bright House Apartment

Project Phase 2

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Table Of Contents

Motivation.....	0
An Overview Of The Current System	1
Mission Statement.....	14
Mission Objectives.....	14
Scope And Boundary.....	15
Subsystem Definitions.....	15
□ Customer Relationship Management.....	15
□ Customer Lease Management.....	16
□ Customer Payment Management.....	16
□ Room Services.....	16
□ Room Maintenance	16
□ Inventory Management.....	16
□ Purchasing Management.....	17
□ Employee Payroll Management	17
□ Human Resource Management	17
□ Accounting.....	17
Major User View & Operations.....	18
BranchManagement Users' View.....	20
BranchEmployee Users' View	21
Customer Users' View	21
User's Requirement Specifications	21
BranchManagement.....	21
Data Requirements	21
Transaction Requirements	24

BranchEmployee	27
Data Requirements	27
Transaction Requirements	29
Customer	31
Data Requirements	31
Transaction Requirements	32
System Specifications.....	32
Initial Database Size.....	32
Database Rate Of Growth	33
Types And Average Number Of Record Searches	33
Networking And Shared Access Requirements	33
Performance	33
Security.....	34
Backup And Recovery.....	34
Legal Issues	34
Entity-Relationship Diagram.....	35
Entity Type Specification List	36
Relationship Type Association	37
Entity Key List.....	39
Constraints & Business Rules	42
Constraints	42
Business Rules.....	46
The User Transaction.....	48
User Transactions Pathway Checking.....	50



PHASE 1 CHANGELOG

- Added a description for all subsystems in the scope of the project.
- Created a new form for purchasing order.
- Created a new form for maintenance
- Expanded the scope to cover **Room Maintenance** and **Accounting** as well as **Payroll**
- The word "Supply" and "Inventory" are now related and usually used together.
- **Room Management** and **Booking System** are now merged into **Customer Lease Management**
- **Changes will be highlighted**

Project Title: Bright House: Apartment Management System



Motivation

Bright House apartment is an apartment chain based in Pattaya City, Chonburi, Thailand established in 2017. It has 10 branches scatter throughout Chonburi. Each Branch has 10 - 16 rooms. It offers accommodations at reasonable prices for daily and monthly rental. Most of its customers are foreigners; therefore, additional information such as passport and Visa number has to be kept. Despite its numerous branches, Bright House still using traditional ways of operating. For example, many processes such as accounting, room information, utility tracking, room reservation, and room scheduling are done manually by employees using papers. Thus, during high seasons, front counter employees have to deal with complicated and redundant tasks including searching for available rooms. Moreover, with the director's vision of expanding the business, a database system must be introduced in order to introduce non-existing customer relationship management and mitigate human involvements, which are erroneous. Therefore, a database system must be developed to support the operations of Bright House.

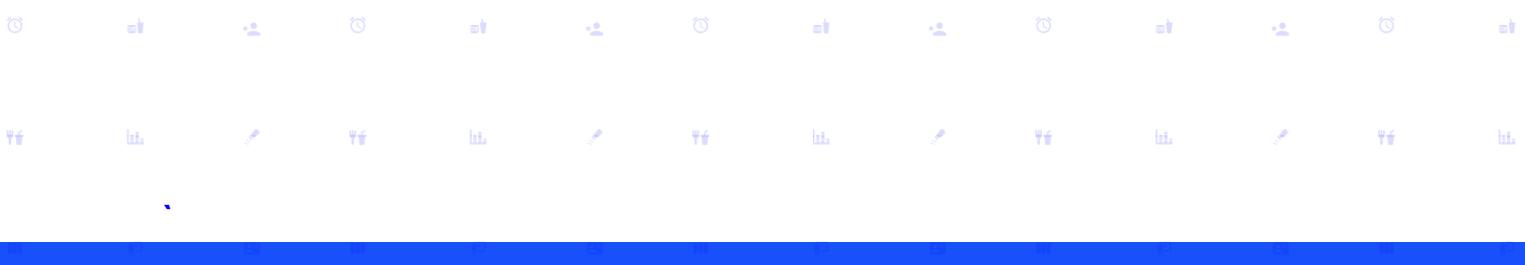
An Overview of the Current System

A brief description of Bright House's business processes is provided. Bright House is specialized in an apartment for rent especially for foreigners in Pattaya, which is a popular traveler destination, and nearby regions. Bright House currently has 10 branches operated by approximately 80 staff. There are various business processes that require forms and reports.

Room Schedule Book Page (Form)

ROOM	1 - 5	6 - 10	11 - 15	16 - 20	21 - 25	26 - 30
101	6/6 - 20/6 Daily Suwanee		19/7 - 17/8 Monthly Smith			3/12/2019 - 1/3/2020 Michael Snake
102	6/6 - 20/6 Daily Suwanee	25/6 - 25/7 2,000 Robert, 10U		26/7 - 30/7 Danny, 500	13/8 - 2/9/19 John Blythe	ສັນຕິພາບໄຫມ->
103						
201	1/6 - 1/7/19 Neoiville		19/4-26/7 Peter W.			

When a customer asked the staff at the counter, in a branch of Bright House, for booking information and available rooms, the staff will look up in the Room Schedule Book which belongs to a branch and includes a representation of a timeline that emphasizes the availability of each room identifiable by using room number. This process usually takes a considerable amount of time as the staff has to skim through several pages. The schedule will be updated when there are new changes to any room. An example of room 101, 102, 103 and 201 **Room Schedule Form** is shown in **figure 1**.



Reservation Form

Bright House
Reservation Form

Booking Full name (ชื่อ-นามสกุล ของผู้จอง)

Mr. Peter Tarlay

Guest Full name (ชื่อ-นามสกุล ของผู้พัก)

Same as booking name

Booking Date

DAY 10	MONTH 5	YEAR 2019
------------------	-------------------	---------------------

Check-in Date

DAY 23	MONTH 5	YEAR 2019
------------------	-------------------	---------------------

Total Months

Total Days **29**

Check-out Date

DAY 21	MONTH 6	YEAR 2019
------------------	-------------------	---------------------

Rental Price

12,000

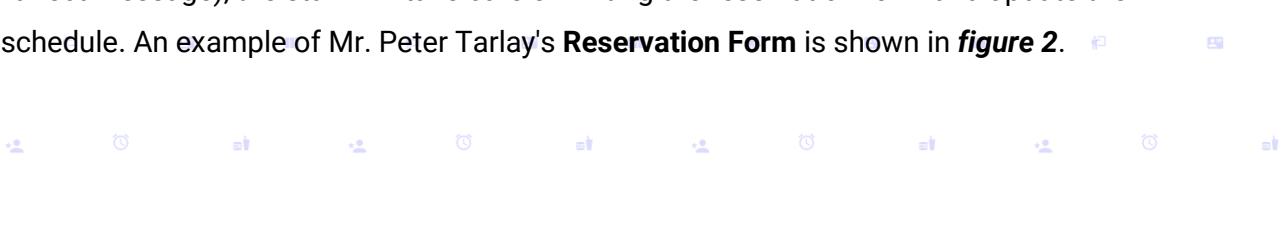
THB

per Day/

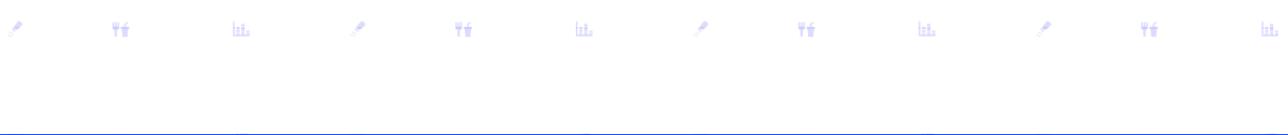
Electricity and Water fee Included in Rental Price

Deposit

5,000



To facilitate customers who want to stay during high seasons, where most rooms are occupied, the reservation form is used to keep track of room availability, a reservation can be made by sending an email, making a phone call or walking into a Bright House branch. When an appointment is made at a counter front or remotely (e.g. phone, email, or social media direct message), the staff will take care of writing the reservation form and update the room schedule. An example of Mr. Peter Tarlay's **Reservation Form** is shown in **figure 2.**



Check-in/out Form

Bright House
Guest Check-in/out Form

PERSONAL INFORMATION (ข้อมูลส่วนบุคคล)

Full name (ชื่อ-นามสกุล) Profession (อาชีพ)

Address (ที่อยู่)

Date of Birth (วันเกิด) Nationality (สัญชาติ) Telephone (เบอร์โทรศัพท์)

DAY 04	MONTH 04	YEAR 1963
-----------	-------------	--------------

IDENTIFICATION INFORMATION (ข้อมูลการระบุตัวตน)

ID Card Number/Passport Number VISA Class Immigration No. (เลข ต.ม.)

Date of Arrival (วันที่เข้าประเทศ) Date of Departure (วันที่ออกประเทศ)

DAY 23	MONTH 5	YEAR 2019
-----------	------------	--------------

DAY 23	MONTH 7	YEAR 2019
-----------	------------	--------------

Guest's Signature (ลายเซ็นของ)

Bright House will not be held liable for valuable items left by guests in the rooms, please keep your valuables with you.

นโยบายห้องพัก จะไม่รับผิดชอบทรัพย์สินมีค่าใด ๆ กรุณานำทรัพย์สินติดตัวทุกครั้งก่อนออกจากห้องพัก

CHECK-IN INFO (ข้อมูลการเข้าพัก)							
Room Number <input type="text" value="203"/>	Deposit (ค่ามัดจำทุกอย่าง) <input type="text" value="5,000 THB"/>	PAX (จำนวนแขก) <input type="text" value="1"/>					
Check-in Time (เวลาเข้าพัก) <table border="1" style="display: inline-table; vertical-align: middle;"> <tr> <td>DAY 23</td> <td>MONTH 5</td> <td>YEAR 2019</td> <td>Hour 16</td> <td>Minute 30</td> </tr> </table>			DAY 23	MONTH 5	YEAR 2019	Hour 16	Minute 30
DAY 23	MONTH 5	YEAR 2019	Hour 16	Minute 30			
Check-out Time (เวลาออก) <table border="1" style="display: inline-table; vertical-align: middle;"> <tr> <td>DAY 21</td> <td>MONTH 6</td> <td>YEAR 2019</td> <td>Hour 18</td> <td>Minute 30</td> </tr> </table>			DAY 21	MONTH 6	YEAR 2019	Hour 18	Minute 30
DAY 21	MONTH 6	YEAR 2019	Hour 18	Minute 30			
Room Rate <input type="text" value="12,000 THB"/> per Day/Month							
Clerk's Signature (ลายเซ็น พนักงาน) <input type="text" value="Apisit Raj."/>							

REMARKS (หมายเหตุ) <input type="text" value="ผู้ก่อการร้ายได้บุกเข้าห้องพักแล้ว"/>		
CHECK-OUT INFO (ข้อมูลการออกพัก)		
Additional Expenses (THB) <input type="text" value="1000"/>	ELECTRICITY <input type="text" value="270"/>	WATER <input type="text" value="270"/>
Clerk's Signature (ลายเซ็น พนักงาน) <input type="text" value="Apisit Raj."/>		
Guest's Signature (ลายเซ็นของ) <input type="text" value="Peter Tarlay"/> Sign to get Deposit and return the key.		

Once a customer desires to book and stay at one of Bright House branches, to keep track of customer information and their stays at Bright House, the staff at the front counter of that branch will prompt the customer to enter their personal information on the Bright House check-in/out form. The form is used will be kept and organized grouped by rooms. Once everything is filled, the staff will verify and shows the customer a room. **Figure 3** shows the **Check-in/out form** of Mr. Peter Tarlay.

Key chain Rental Report

Bright House
Room 203
 Don't remove from the room key chain

Branch name (ชื่อสาขา)
Tanachon

Guest Full name (ชื่อ-นามสกุล ของแขก)
Mr. Peter Tarlay

Check-in date (วันที่เช็คอินพัก)
 DAY: **23** MONTH: **5** YEAR: **2019**

Check-out date (วันที่เช็คออกจากพัก)
 DAY: **21** MONTH: **6** YEAR: **2019**

Notes
**Clean: Mon + Thu
 Deposit: 5,000 thb**

To keep track of backup keycards of each occupied room at the counter, the Key Chain Rental Report is attached to each keycard to identify the rent and its customer as well as the room. The backup keycard will be used extensively for cleaning services. **Figure 4** shows an example of a room 203 **Key Chain Rental Report**.

Room Supply List (Form)

To keep track of the maximum amount of room supplies to give, the Room Supply List will be given to each room for employees to check and refill those supplies to a specified amount depends on the rental type. If the rental type is monthly, then room supplies will be provided at the start of the rental once. If the rental type is daily, then room supplies will be provided daily. Furthermore, the maximum amounts of supply are varied based on customer requests, the rental type and the rental period of a stay. When a customer request is given, the staff will jot down the description of the request onto the supply list and determine the total amount of supplies that needed to be provided. **Figure 5** shows the **Room Supply List Form** for room number 203.

Bright House
Room 203
Room Supply List

Branch name (ชื่อสาขา)
Tanachon

Room Size (ขนาดห้อง)
Superior

Rental Type (ประเภทของการเช่า)
Monthly

Item Name (ชื่อของ)	Maximum Quantity (จำนวนสูงสุด)
น้ำเปล่าขวดใหญ่	2
กาแฟช่อง	2
สบู่ก้อน	2
ทมากรคุณแม่	2

Notes

Monthly Room Cleaning Check List (Form)

To keep track of room cleaning service over a month, the **Monthly Room Cleaning Check List** is used as a form for cleaning staff to track, schedule and record their service which consists of multiple subtasks. An example of the **Cleaning Check List** for December 2019 is illustrated in **figure 6**.

Branch Supply Stock List (Report)

Once a Bright House branch needs to restock their supply inventory, a Branch Supply Stock List is generated to be used to decide which items to resupply. **Figure 7** shows the Stock List generated on 26 January 2020.

Room Utility Report Form

Bright House
Room Utility Recording Form

Room Number (ห้องที่พัก) Guest Full name (ชื่อ-นามสกุล ของแขก)
203 **Peter Tarlay**

Check-in date (วันที่เช็คอิน) Check-out date (วันที่เช็คเอาต์)
23 **5** **2019** **21** **6** **2019**

UTILITY RECORDINGS (รายงานค่าน้ำค่าไฟ)

Electricity (ค่าไฟ)	Meter before Guest stay (meter before guest stay)	→	Meter after Guest stay (meter after guest stay)	Used (จำนวนที่ใช้)
3486 UNITS	3611 UNITS	=	125	
85 UNITS	94 UNITS	=	9	

To calculate the utility costs and charge customers in the month, in each monthly stay, the total amount of water and electricity utilities that can be read from meters of a room will be recorded in units by an employee using the Room Utility Report Form as shown in **figure 8** which illustrates an example for room 203.

Room Utility Summary

Bright House
Room Utility Summary

Created Date (วันที่สร้าง)
21 **6** **2019** **19** : **19**

ROOM INFORMATION (ข้อมูลห้อง)

Room Number (เลขห้อง) Guest Full name (ชื่อ-นามสกุล ของแขก)
203 **Peter Tarlay**

UTILITY REPORT (รายงานค่าน้ำค่าไฟ)

Electricity (ค่าไฟ)	Unit Used (หน่วยที่ใช้ไป) 125 UNITS	×	Rate per Unit (อัตราต่อหน่วย) 8 THB	=	Total (ยอดรวม) 1000 THB
Water (ค่าน้ำ)	Unit Used (หน่วยที่ใช้ไป) 9 UNITS	×	Rate per Unit (อัตราต่อหน่วย) 30 THB	=	Total (ยอดรวม) 270 THB

Total Utility Cost (ยอดรวมทั้งหมด) **1270 THB**

In order to charge monthly-stay customers for electricity and water cost, both costs must be calculated by multiplying the total unit used and the price per unit and recorded to the Room Utility Summary as illustrated in **figure 9**. The monthly-stay customer will have to pay the utility every month as long as the duration of their stay.

Occupied Room List (Report)

In order to make keeping track of guests in a branch easier, the occupied room list is used. Cleaning personnel, security, a branch manager could use this report to adjust their services efficiently. As shown in **figure 10**, the **list of the occupied rooms** of the branch Tanachon is illustrated.

Payment Bill (Report)

To provide evidence of customer payment, a payment bill is written every time the customer checks in and the bill will be completed when the rental fee is paid at the counter in the branch that they stay. Moreover, the deposit will also be returned to the customer. A **payment bill** is also created when other types of transactions are made. For example, a customer requests extra cleaning services, or purchase bottles of fresh water, etc. **Figure 11** illustrates a payment bill for Mr. Peter's rental. Please note that utility costs will not be recorded inside the bill because they will be charged monthly separately by using the **Room Utility Summary** report.

Bright House Payment Bill		Branch name (ภาษาไทย) Tanachon
Guest Full name (ເຊື່ອ-ນາມສະກຸນ ຖະແຫຼງ)	Date (ວັນທີ) 21/6/2019	
Description	Amount (THB)	
Room Rental	12,000	
Deposit	5,000	
★ TOTAL	17,000 THB	
Clerk's Signature (ບໍລິສັດ ຂັນ, ດົກເຈີນ)	<u><i>Apisit</i></u>	

Employee Application Form

Bright House

Employee Application Form

APPLICANT PERSONAL INFORMATION (ข้อมูลส่วนบุคคลของผู้สมัครงาน)

Full name (ชื่อ นามสกุล) **Mr. Supachai Jaidee**

Telephone (เบอร์โทรศัพท์) **081-394-3849**

Address (ที่อยู่) **206/2 Moo 5, Soi Naklua 12, Naklua, Banglamung**

Date of Birth (วันเดือนปี) **Year: 12 Month: 12 Year: 1986**

Nationality (เชื้อชาติ) **Thai**

Religion (ศาสนา) **buddhism**

Email / LINE ID **suppy.ai@hotmail.com**

IDENTIFICATION INFORMATION (ข้อมูลการระบุตัวตน)

ID Card Number / Passport Number **5216183680833**

APPLICATION INFORMATION (ข้อมูลการสมัครงาน)

Desired Roles / Responsibilities (หน้าที่ที่ต้องการจะได้จากการหางาน) **Cleaning Personnel**

Applicant's Signature (ลายเซ็นผู้สมัครงาน) *Supachai Jaidee*

SKILLS & QUALIFICATIONS (ทักษะและคุณสมบัติ) * **

Hospitality Industry skills (ทักษะอาชีวศึกษาด้านการบริการในโรงแรม)

Excellent cleaning & hospitality skills
He's very proficient in all tasks that are given to him!
He is also very friendly to foreigners.

English Communication skills (ทักษะภาษาอังกฤษสำหรับชาวต่างด้าว)

**He talks very fluently!
He's also strong in listening skills.**

EMPLOYMENT (การรับจ้าง) **

Assigned Roles / Positions (หน้าที่ที่ได้รับมอบหมายโดยนายจ้าง) **Cleaning Personnel**

Branch (สาขา) **Tanachon**

Working Hours (เวลาทำงาน) **Mon-Sat, 8:00 - 16:00**

Salary Per Day (เงินเดือนต่อวัน) **400**

EMPLOYMENT DATE (วันที่เริ่มการรับใช้) **THB: 26 Month: 1 Year: 2017**

Employer Signature (ลายเซ็นผู้รับจ้าง) *Apisit Raj.*

* Skills and Qualification will be tested.
** Must be filled by Employer only.

To facilitate servicing, payroll, branch stock tracking, and accounting, when a job applicant applies for a job at Bright House, the applicant must write their information to the registration form. Later the applicant will be tested in various hospitality skills. Each applicant can have multiple tasks given by the branch manager. Moreover, application date, work experience, and English skills will also be recorded as well. **Figure 12** shows Mr. Supachai Jaidee's **application form**.

Branch Employee Listing (Report)

To help a branch manager in managing employees, a branch employee list is used to shows the name, position, and daily salary for all employees as shown in ***figure 13***.

Employee Weekly Payroll Report

Typically, Work attendance and work hours will be kept for every employee every week. Later the branch manager will payroll their employees depends on their work hours over the week and performances. To facilitate the payroll process, an employee Weekly Payroll Report, as shown in **figure 14**, must be created before any payroll transaction could happen.

Ledger (Form)

Date (วันที่)	Description (รายละเอียด)	Accountant Signature (ลายเซ็นนักบัญชี)	Income (รายรับ: THB)	Expense (รายจ่าย: THB)
9/5/2019	ห้อง 206: ค่าห้อง	Suwanna Roj.	10,000	-
9/5/2019	ห้อง 206: ค่าไฟ	Suwanna Roj.	160	-
9/5/2019	ห้อง 206: ค่าน้ำ	Suwanna Roj.	100	-
11/5/2019	ห้อง 305: ค่าห้อง	Suwanna Roj.	10,000	-
11/5/2019	ห้อง 305: ค่าไฟ	Suwanna Roj.	584	-
11/5/2019	ห้อง 305: ค่าน้ำ	Suwanna Roj.	100	-
12/5/2019	ห้อง 306: ค่าห้อง	Suwanna Roj.	12,000	-
12/5/2019	ห้อง 306: ค่าไฟ	Suwanna Roj.	550	-
12/5/2019	ห้อง 306: ค่าน้ำ	Suwanna Roj.	120	-
13/5/2019	เชื้อเพลิง 4 รุ่น	Suwanna Roj.	-	1,600
14/5/2019	กมส	Suwanna Roj.	-	120
14/5/2019	น้ำแฝกเล็ก	Suwanna Roj.	-	60
14/5/2019	น้ำแฝกเล็ก	Suwanna Roj.	-	60
14/5/2019	ห้อง 202 ค่าห้อง	Suwanna Roj.	10,000	-
14/5/2019	ห้อง 202: ผ้าทำ	Suwanna Roj.	5,000	-
15/5/2019	เชื้อเบกครึ่งวัน	Suwanna Roj.	-	200

Similar to most businesses, to record every financial transaction related to Bright House, each branch will have its own **financial Ledger**, as shown in **figure 15**, managed by a branch manager, that records incomes and expenses in day-by-day operations.

Branch Supply Tracker (Form)

- In order to monitor transactions of supply inventory with efficiency and transparency in each branch, Branch Supply Tracker is used as a form by a branch accountant. **Figure 16** shows the supply tracker used by Tanachon Branch.

Bright House Guest Feedback Form

GUEST INFORMATION (ຂໍອມສູງເຫັນພັກ)

Full name (ຊື່-ນາມສະກຸນ) Room Number (ເຮັດວຽກ) Branch (ສາທາາມ)

FEEDBACK (ສ້ອເສນອແນະ)

Categories (ປ່ຽນທາງຂອງການສອນແນະ)

- Room
- Atmosphere
- Room Service
- Counter front Service
- Hallways
- Security
- Billing
- Other: _____

Feedback Detail (ກ່າຍຮັດເລື່ອຄ້ອນແນະ)

- The room is little bit dark. The AC is cold enough to me.
- The room service is very very nice. The staff is very friendly.
- The counter front service is little bit slow when finding an available room for me. That needs to be improved.

Purchase Order

REQUESTOR INFO (ຂໍອມສູງຮ່ວມການສົ່ງ)

Full name (ຊື່-ນາມສະກຸນ) Position (ຕິດຕາມ) Brief Description (ກ່າຍເຊີ້ນໃຈຮ່ວມການ)

PERSONS-IN-CHARGE INFO (ຂໍອມຜູ້ຮ່ວມການ)

Full name (ຊື່-ນາມສະກຸນ)	Position (ຕິດຕາມ)
Apisit Rojanaridpiched	Apt. Manager
Supachai Jaidee	Cleaning Personnel

VENDOR INFO (ຂໍອມຫຍາຍຮ່ວມການ)

Vendor Name (ຊື່ຮ່ວມການ)
Vendor Phone Number (ເບີໂທຫ່າຍຮ່ວມການ)

ITEM LIST (ໄກກາສິນຄ້າ)

Quantity (ໄດ້ຮັດ)	Item Description (ການສະແດງ)	Unit Price (ຕົວຫຼາຍ)	Discount (ເນື້ອມງານ)	Unit Total (ລາຄາທຳມາດ)
5	Nescafe 3 in 1 Blend & Brew ໄມ້ເຫັນ 40 ວັດ 15.5 ກົມ / ຕັບ	145	10 X 3	405
5	Dove ນໍາມັກຕັບຕົກ ດາວວັນນີ້ 800 ວັດ 15.5 ກົມ	145	25 X 5	600
2	ເມັນດັກ ສັກຕົກ ເພື່ອກ່າວ ພະຍາກ 2000 ກົມ	119	6 X 2	356
6	ຫົ້ວໜ້ວ ດັກຕົກ 100 ວັດ 15.5 ກົມ	59	-	348
1	ຊົ່ວໜ້ວໜ້ວ ພະຍາກ 100 ກົມ	190	-	190

Total Quantity: Total Value:

VERIFICATIONS

Requestor Signature (ກ່າຍເຊີ້ນໃຈຮ່ວມການ) Vendor Rep. Signature (ກ່າຍເຊີ້ນໃຈຮ່ວມການ) Time Purchased (ເວລາທີ່ໄດ້ຮັດ)

Customer Feedback Form

To improve overall services, all guests can give their feedback during or after each rental. All feedback will be kept by a branch manager for further improving processes.

Figure 17 shows Mr. Peter Tarlay **feedback** form after his rental ends.

Purchasing Form

When a branch manager requires its employees to resupply a branch inventory, a purchasing form will be issued by the branch manager. Products to be bought are listed by the manager. The branch manager will assign employees that are in charge of the purchasing. If the branch manager does not select any specific vendor, the ones in charge can select any vendor. After products are checkout, the ones in charge have to record the price and discount of each product into the form as well as ask a vendor employee to sign their signature to verify their acknowledgment. **Figure 18** shows Mr. Apisit, a branch manager, requests 5 products to be bought using the purchasing form.

Maintenance Form

When damage to the property of an apartment is discovered, a maintenance form will be written by an employee who discovers it. The form will be reviewed by the branch manager. If the damage needs to be mitigated, the branch manager will assign the ones in charge. Ones in charge can be an employee of any position, who is capable of repairing, or external personnel such as repairman. In some instances, supply, such as screwdriver, screws, are required for maintenance; thus, they are listed on the form. **Figure 19** shows a **maintenance form** for repairing a curtain rail requested by Mr. Apisit.

Mission Statement

The purpose of the **Bright House database system** is to manage, organize and secure all operational data that facilitates unified efficient high-quality service and resource management through minimized data redundancy and consistency.

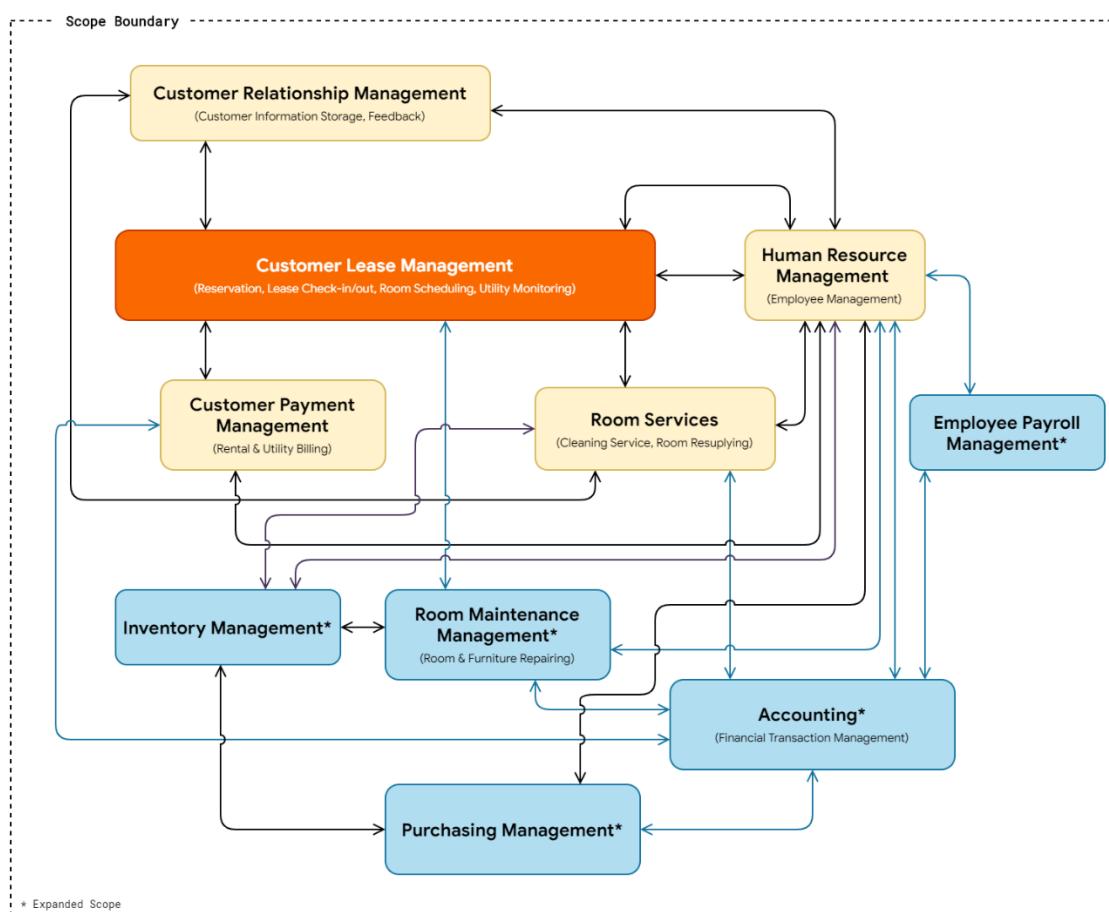
Mission Objectives

The Mission Objectives for the **Bright House database system** are specified as follows:

- To manipulate (insert/update/delete) data of apartment rooms, room supply services, employees, rentals, customers, room utility, payment, supply inventory, maintenance, payrolls, and purchasing.
 - To facilitate various time-consuming processes such as room assigning and room scheduling.

- To enable detailed customer data and feedback data capture that can facilitate customer relationship management.
- To report on branches, employees, rooms, room servicing, supplies, rents, customers, expenses from supply inventory, maintenance, payrolls, and purchasing check-in, and check-out instances.
- To perform searches on branches, employees, rooms, room servicing, supply inventory, maintenance, payroll, purchasing, rents, customers, expenses from payrolls, purchasing, check-in, and check-out instances.

Scope and Boundary



Subsystem Definitions

- **Customer Relationship Management**

The subsystem is responsible for the storage of customer information and customer feedback that facilitates personalization by using historical data to communicate with old customers in order to retain and gain loyalty to

generate more income as well as improving overall services via feedback collection.

- **Customer Lease Management**

The **Customer Lease Management system** manages rentals and reservations that are made by customers. It also specifies rental prices associated with the room size and rental type (e.g. monthly or daily rent). It also deals with room utility monitoring to facilitate in billings of monthly rents.

Furthermore, the system also facilitates faster counter-front service by providing a counter officer (a branch manager) a way to search for an appropriate room that does not conflict with other reservations or rental.

- **Customer Payment Management**

The **payment system** supports the process of persisting customers for their rental fees, additional room services, and property damage penalty fee.

- **Room Services**

The **room service** subsystem is responsible for the persistent and scheduling room service routine, which includes periodic room cleaning and room resupplying.

- **Room Maintenance**

The **room maintenance system** enables each branch to monitor and persist maintenance tasks performed on apartment properties (such as furniture and decorations) as well as monitor resources that are being used to carry out each maintenance.

- **Inventory Management**

The **inventory management system** enables each branch to monitor the direction of how branch-owned properties are being used. Branch-owned properties or items can be categorized into 3 groups:

1. **Consumable supply that does not required to be returned** such as rolls of tissue paper.
2. **Consumable supply that can be returned to the inventory** such as sticky tapes and floor wax.
3. **Non-consumable items** such as furniture and decorations.

- Purchasing Management

The **purchasing management system** persists vendor information and purchasing orders made by branch managers. It works in conjunction with the accounting system.

- Employee Payroll Management

The **employee payroll system** works in conjunction with the Human Resource Management system and accounts system in the sense that it gets the number of working hours of employees and calculate total payroll and makes a transaction record in the accounting system.

- Human Resource Management

The **Human Resource management system** is the main system in the sense that it interacts with most subsystems and is responsible for the storage of employee information, salary, working hour, daily tasks, job application information, and job position.

- Accounting

The **accounting system** acts as central storage for all financial transactions made internally for all customer payments, payrolls, and purchasing.

Major User View & Operations

Data	Access Type	Owner	Apartment Manager	Accountant	Cleaning Personnel	Security	Customer
All Branches	Maintain						
	Query	✓	✓				
	Report	✓	✓				✓
Single Branch	Maintain		✓				
	Query		✓				
	Report		✓				
All Employees	Maintain						
	Query	✓	✓				
	Report	✓	✓				
Branch Employee	Maintain		✓				
	Query		✓				
	Report		✓	✓	✓	✓	✓
All Customers	Maintain						
	Query	✓	✓				
	Report	✓					
Branch Customer	Maintain		✓				
	Query		✓				
	Report		✓				
All Supply Inventory	Maintain						
	Query	✓					
Branch Supply Inventory	Report	✓	✓	✓			
	Maintain			✓			
All Room Services	Query	✓					
	Report	✓					
Branch Room Service	Maintain				✓		
	Query		✓		✓		
	Report		✓		✓		
All Rooms	Maintain						
	Query	✓					
	Report	✓	✓				
Branch Room	Maintain		✓				
	Query		✓		✓	✓	
	Report		✓		✓	✓	✓
All Customer Payments	Maintain						
	Query	✓					
Branch Customer Payment	Report	✓	✓	✓			
	Maintain		✓				
All Room Utilities	Query	✓					
	Report	✓	✓	✓			
Branch Room Utility	Maintain		✓				
	Query		✓		✓		
	Report		✓		✓		
All Reservations	Maintain						
	Query	✓	✓				
	Report	✓					
Branch Reservation	Maintain		✓				
	Query		✓				
	Report		✓	✓	✓	✓	✓
All Rentals	Maintain						
	Query	✓	✓				
	Report	✓	✓				

Data	Access Type	Owner	Apartment Manager	Accountant	Cleaning Personnel	Security	Customer
Branch Rental	Maintain		✓				
	Query		✓				
	Report		✓		✓	✓	
All Payrolls	Maintain						
	Query	✓					
	Report	✓	✓	✓			
Branch Payroll	Maintain		✓				
	Query		✓	✓			
	Report		✓	✓	✓	✓	✓
All Financial Transaction	Maintain						
	Query	✓					
	Report	✓	✓	✓			
Branch Financial Transaction	Maintain			✓			
	Query		✓	✓			
	Report		✓	✓			
All Maintenance	Maintain						
	Query	✓					
	Report	✓	✓	✓			
Branch Maintenance	Maintain		✓				
	Query		✓	✓			
	Report		✓	✓	✓	✓	✓
All Purchasing	Maintain						
	Query	✓					
	Report	✓	✓				
Branch Purchasing	Maintain		✓	✓			
	Query		✓	✓			
	Report		✓	✓	✓	✓	✓

Figure 17 is the result of an analysis of major user views with respects to the data requirements of each position as well as the basic data operations: maintain, query and report. The main types of data used by each user's view are illustrated in a simpler a cross-reference table as illustrated in **table 1**.

Data	Director	Apartment Manager	Accountant	Cleaning Personel	Security	Customer
Branch	✓	✓				✓
Employee	✓	✓	✓	✓	✓	
Customer	✓	✓	✓	✓	✓	
Supply Inventory	✓	✓	✓	✓		
Room Service	✓	✓		✓		
Room	✓	✓		✓	✓	✓
Customer Payment	✓	✓	✓			
Room Utility	✓	✓	✓			
Reservation	✓	✓	✓	✓	✓	✓
Rental	✓	✓		✓	✓	
Financial Transaction	✓	✓	✓			
Payroll	✓	✓	✓	✓	✓	
Maintenance	✓	✓	✓	✓	✓	
Purchasing	✓	✓	✓	✓	✓	

According to **table 1**, it can be observed that the Director and Branch Manager completely share the same data access characteristic; thus, both of them are merged into a group of **BranchManagement**. Furthermore, since the accountant, cleaning personnel and security share similarities in data access and requirements. They also are the positions that bound to only a branch; therefore, the name of **BranchEmployee** is given to the group. Lastly, customers also have their own Customer Users' Views because of their unique data requirements.

BranchManagement Users' View

- **Director** responsible for making the overall business decisions; therefore, extensively relevant summary reports are mandatory.
- **Branch Manager** is considered to be a receptionist at a branch responsible for managing room **reservations**, payments, rentals, payments, etc. Moreover, a branch manager will also be the one who carries out Customer Relationship management.

BranchEmployee Users' View

- An **accountant** is responsible for managing a branch's supplies, incomes, and expenses.
- **Cleaning Personnel** responsible for room resupplying and cleaning services. Cleaning personnel can withdraw supplies via an accountant directly.
- **Security** is responsible for the overall security of an apartment branch. They are allowed to access information that can be helpful while in duty. That information includes branch employees, room information, and customer rental.

Customer Users' View

- A **Customer** has access to gain knowledge, that helps to generate awareness of the business, room availability, branches as well as **reservations** using Bright House's public online channels. A customer can also keep track of the feedback that they submitted.

User's Requirement Specifications

BranchManagement

DATA REQUIREMENTS

1. BRANCH

Bright House apartment has multiple branches scattered throughout the eastern region of Thailand. Each branch is managed by has employees which also include the branch manager who responsible for the daily operation of the business. The description of branch data includes the manager name, full branch name, up to 3 telephone numbers, address, fax number, email address, opening hours, and date of establishment. Additionally, the date that the manager gets his or her position at the current branch is also recorded.

2. EMPLOYEE

As a manager, the employee data is used to consider when an employee applies for a job. Moreover, it is also used to estimate the salary of employees. Employees must provide Citizen ID Number, First name, Last name, Phone numbers, Nationality, and Work experience. Additionally, gender, work position, and associated branch number.

3. CUSTOMER

To facilitate the growth of the business by using customer relationship management, Bright House will emphasize on unifying customer information between branches to create a seamless data boundary between branches. All personal information given by the customers will be stored in terms of first name, middle name, last name, nationality, identification number or passport number, date of birth, contacts such as emails, Facebook account, and telephone numbers. As well as individual customer feedback that is also important for business growth. After receiving customer feedback, a branch manager will keep a record of those.

4. SUPPLY INVENTORY

Each supply that belongs to each branch must be recorded by a branch accountant to increase the transparency of inventory in every branch; therefore, item name, item type, time of the stock transaction as well as the quantity and transaction types (e.g. incoming, outgoing) must be stored. Additionally, for each record, the name of the person in charge and another one, who oversees the transaction, is also required and will also be recorded as well.

5. ROOM SERVICE

To ensure that the service will cover every customer in each branch and facilitate the scheduling of works, each record of room service will have the timestamp of service request creation, the status of the service (e.g. scheduled, in-progress, finished), the target room number, the name of the cleaner, the time that the service is finished, the type of the service and the subtasks will also be recorded.

6. ROOM

Since each branch manager has to take care of all the rooms in the apartment, room information should be exposed and consist of the room number, room size, furniture list, room supply list, and location (e.g. branch, building, floor number). Room numbers are not unique across all branches.

7. CUSTOMER PAYMENT

To enable a systematic way to generate financial reports, any customer payment such as utility payment, rental payment or extra cleaning service payment will be recorded in terms of the transaction time, the amount, the name of the customer and the money receiver name.

8. ROOM UTILITY

Since utility must be manually kept tracked for each room, before any rental, a branch manager must record the room's water and electricity initial unit when customer check-in and the final amount unit when customer check-out to calculate the total utility cost. Time Recorded, the room number, the rental number, the number of units of electricity, and the number of units of water will be recorded.

9. RESERVATION

When a customer sends a reservation message to a branch manager, the manager should keep important information such as customer name, the time which the reservation starts, duration of the reservation, room number, the name of a responsible employee, the time which the reservation is created, and special request note. There is no limit on the number of reservable rooms.

10. RENTAL

To secure customer rental data, rental number, rental time, rental duration, rental ending time, rental fee, rental room number, the branch, rental customer name, additional remark and rental type (e.g. daily or monthly) are required and need to be recorded to facilitate in the process of generating useful reports. Please note the rental number is unique across all branches.

11. PAYROLL

Since employees are the main driver of the business, integrating payroll into the system could enable transparency to all employees. For each employee, starting time and ending time for each working day will be recorded. Thus, when it is for employees to obtain a salary, total working hours will be calculated individually to finally calculate the actual salary. Each employee can query and get a report of their payrolls to ensure transparency.

12. FINANCIAL TRANSACTION

Since there are transactions from customers (from room rental, extra room services, and property damage fine), purchasing, and payrolls, the financial transaction system must integrate every money transfer similar to the financial ledger. Accountants can also review each financial transaction to ensure financial integrity.

13. MAINTENANCE

Since occurrences of property damage are not rare, all maintenance should be recorded in terms of description, starting time, ending time, status, and category of maintenance.

This also helps branch managers to keep track of maintenance that sometimes take a long time to complete. Please note that some time property damage is caused by customers. If the damage done is severe, they will be charged additionally.

14. PURCHASING

In order for a branch to operate normally, it relies on external products such as washing powder, floor wax, etc.; as a consequence, purchasing becomes a regular task. Each instance of purchasing will be recorded in terms of vendor, status, type, created time, approval time, rejected time. The level of details of each purchasing will be each purchasing line which includes only one product or supply. Before any purchase can take place, it must be approved by either a branch manager or an accountant.

TRANSACTION REQUIREMENTS

DATA ENTRY

1. Enter the details of a new **Branch** (such as branch ID 1; "Tanachon", manager ID 1, ...).
2. Enter the details of a new Member of an **Employee** at a branch (such as Supachai Jaidee).
3. Enter the details of a new **Customer** who check-in for the first time at the front counter at a branch. (such as Peter Tarlay).
4. Enter the details of a new **Room** in a Branch (such as room number 203 is a superior room, which consists of a bed, a television, a wardrobe, and a safe, located on the 2nd floor at Tanachon branch).
5. Enter the details of new **Customer Payment** (such as payment for room number 203 rented by Peter Tarley).
6. Enter the details of a new **Room Utility** record (such as an electricity utility record of room number 203 on 23/5/2019 is 3486 units).
7. Enter the details of a new **Reservation** record received from a customer email or phone call (such as a reservation record for Peter Tarlay booked on 10/5/2019).
8. Enter the details of a new **Rental** at a branch (such as customer Peter Tarlay is renting and staying at room number 203 at Tanachon branch as a monthly rental started 23/05/2019).
9. Enter the details of a new employee work attendance for the calculation of **Payroll** at a branch (For example, Mr. Supachai Jaidee comes to work at the Tanachon branch at 07:00, and leaves the work at 21:00).

10. Enter the details of a new **Maintenance** instance that occurred within a branch in terms of maintenance description, requestor name and position. Furthermore, start and ending time, operatives who carry out the maintenance and supply used will also be recorded.
11. Enter the details of a new **Purchasing** requested by anyone who is a branch employee. Requestor information, a brief description, person-in-charge list, vendor info and item list (only item description and unit price are required) must be specified.

DATA UPDATE/DELETION

1. Update/delete the details of a **Branch**.
2. Update/delete the details of a member of **Employee** at a branch.
3. Update/delete the details of a **Customer** including feedback.
4. Update/delete the details of a **Room** in a Branch.
5. Update/delete the details of a given **Customer Payment** at a given branch.
6. Update/delete the details of a **Room Utility** at a given branch.
7. Update/delete the details of a room **Reservation** made by a customer **at a given branch**.
8. Update/delete the details of a room **Rental** at a given branch.
9. Update/delete the details of a **Payroll** of a given employee **at a given branch**.
10. Update/delete the details of a **Maintenance** at a given branch. An update will occur when there is a change in maintenance status.
11. Update/delete the details of a **Purchasing** at a given branch. An update of a purchasing will happen after the person-in-charge has proceeded to purchase the items. An update will include time purchased, discounts, and unit price (if any).

DATA QUERIES

1. List the details of **branches** in a given area of the Eastern region of Thailand.
2. List all details of **employees** given an employee ID, name, surname, or branch name.
3. Identify the total number of **employees** in all branches.
4. Identify the average salary of **employees** in each position, gender, branch, ordered in ascending order.
5. List all active branch **managers** ordered by the branch address.
6. List **employee** details by a given position, name, ID, and Date of birth.
7. Identify the total **employee** payroll for a day, week or month.
8. Identify the total number of unique **customers** that have ever visited at least one branch.
9. List unique **customers** that have ever visited at least one branch.
10. Identify the average age of **customers** from each nationality.

11. List **customer** details grouped by a given branch.
12. List **customer** details by a given duration from their last visited time ordered by the duration.
13. List details of **customers** who recently stay more than one branch of Bright House ordered by descending order.
14. List details of **supplies** that are used the most by any branches.
15. Identify the average number of **supplies** left at the end of every week grouped by each the name of the supply.
16. List room details with a status of the **rental** by a given branch or area.
17. List all **rooms** that currently have guests staying grouped by room size.
18. List the details of customer **payment transactions** along with full customer name and nationality that has the top-10-most transaction amounts in a given month.
19. Identify the average **customer payment** amount grouped by transaction type.
20. Identify the average amount of money in **customer payments** grouped by customer's nationality, and ordered by month.
21. Identify the **customer payment** that has the highest amount of money grouped by month, customer's nationality.
22. List the **customer payment** by a given rental number and customer name.
23. Identify the average amount of **customer payments** grouped by month.
24. Identify the frequency of **rental** grouped by month.
25. List all **rentals** that will be **expired** within a given time range at a branch.
26. List all **rooms** that will be **free** within a given time range at any branch in a case the customer must be redirected to another branch.
27. List all **rentals** in any branches associated with a given **customer**.
28. List all **room services** done to a specified **room** within a branch.
29. List all **room services** done to a specified **rental** within a branch.
30. Identify the average duration of **customer rentals** within any branch.
31. Identify the average duration of stay of all **customer** Visa within any branch.
32. List all **branches** ordered by the total number of free rooms within a given time range.
33. Identify **months** that have a high amount of reservations.
34. Identify **months** that have a high amount of income.
35. Identify the difference between income from **rentals** & additional cleaning services and expenses from room supply during high and low seasons.
36. List **feedback** reported by **customers** categorized by branches.
37. Identified the total number of customer **feedback** in each branch.

38. Identified the total number of customer **feedback** grouped by categories.
39. Identified the average number of customer **feedback** per rental.
40. List customer **feedback** from all branches in a given period of time.
41. List all **payrolls** made within a given period of time.
42. List all **employees** that has total **payroll** within a given threshold range.
43. Identify the average of employee **payrolls** in a given time range.
44. List all **maintenance** instances of a branch based on a given maintenance status.
45. For each branch, list all supplies used in all **maintenance** so far.
46. List all **external operatives** that involved in any **maintenance** instance.
47. List all completed **maintenance** instances that took more than a given time duration to complete.
48. List all on-going **maintenance** instances that take more than a given time duration so far.
49. List all on-going **purchasing** instance and its items.
50. Identify the average of a given item out of all **purchasing** instances that contain it.
51. Identify the total sum of money used in **purchasing** instances within a given time range.
52. List all **items** that is included in any **purchasing** instances in a given time range.

BranchEmployee

DATA REQUIREMENTS

1. EMPLOYEE

The data required on employees include employee number, name, surname, citizen ID, date of birth, address, position, gender, phone number. Each employee will have their own position, but they can have more than 1 phone number.

2. CUSTOMER

For the employee, they will need to retrieve some of the customer data including the customer's name and surname, and phone number for the cleaning personnel since they may need to make an appointment with customers.

3. SUPPLY INVENTORY

The accountant of each branch is also responsible for verifying supply transfer that is being withdrawn or deposit from the inventory. Since cleaning personnel is the one who is responsible for refilling customers' rooms with supplies on requests of customer requests or routines, information on branch inventory is needed to be exposed to employees.

4. ROOM SERVICE

To improve customer experience and hygiene inside a room, each rental will come with a cleaning service that will be scheduled based on intervals. There are 2 types of room services: cleaning and supplying. Cleaning service has multiple subtasks all of which will be done by cleaning personnel. The subtasks include wiping the table, sweep the floor, mop the floor, clean the bathroom, change towels, change sheets and pillowcases. Each cleaning personnel has the ability to keep track of their processes. Lastly, the customer can request for additional room services at a price.

5. ROOM

Every employee needs to know room data. However, each position needs a different set of data. For instance, the Accountant needs to know room number, room size, furniture list, room supply list, while cleaning personnel need to know the building, room number, furniture list, room supply list. As for security, they only need to know about Building, floor number, room number.

6. CUSTOMER PAYMENT

All customer payments will be monitored by a branch accountant. All branch accountants can verify customer transactions to ensure the transparency of all transactions within their respective branches.

7. ROOM UTILITY

The cost of the utility of each room is exposed to a branch accountant for the creation of monthly financial reports. An accountant is also allowed to query utility data for the use of verifying the branch financial ledger.

8. RESERVATION

Some reservation information is exposed to the branch accountant, cleaning personal and security in order to help in various processes such as cleaning and security scheduling as well as income and expense estimations.

9. PAYROLL

An accountant is only allowed to inspect the payroll records by querying and report. While employees in another position allowed to inspect payroll records but only limited to payrolls that belongs to the individual employee.

10. FINANCIAL TRANSACTION

An accountant is the only position that is allowed to manipulate the financial transaction in a branch. Financial transactions can be either customer rental transactions, payroll

transactions, property damage fine, or purchasing. It is used as a financial ledger for the branch.

11. MAINTENANCE

Any employee that is not a branch manager is allowed to request the branch manager for maintenance. They can get involved in maintenance operations. When maintenance status needs to be updated, operatives cannot do so directly, but instead, they have to inform the manager. Furthermore, the maintenance can also get queried by any employee.

12. RENTAL

Besides a branch manager, an accountant is also allowed to manipulate purchasing instance with a branch. While other employee positions are allowed to get a report of branch purchasing. Similar to maintenance, if an employee desire to made a purchase it must be approved by either a branch manager or an accountant before the purchase happens.

TRANSACTION REQUIREMENTS

DATA ENTRY

- Enter the data of a **Room Service** (such as room 203 with the superior room size and being rent monthly will receive "น้ำเปล่าขวดใหญ่", "กาแฟช่อง", "สบู่ก้อน", "หมวดคลุมผม". Each with a quantity of 2).
- Enter the details of a new transaction of **Supply** (such as "น้ำเปล่าขวดใหญ่แพ็ค" is being transferred into Tanachon Branch with the quantity of 10 pcs. by Supachai Jaidee).
- For accountants, Enter the details of a new **Financial Transaction** made from either customer rental transactions, payroll transactions, property damage fine, or purchasing.
- For accountants, Enter the details of a new **Purchasing** requested any employees likewise to what a branch manager can.

DATA UPDATE/DELETION

- Update/delete the details of a **Room Utility** at a given branch.
- Update/delete the details of a **Customer Payment** at a given branch.

- Update/delete the details of a **Room** at a given branch.
- Update/delete the details of a **Supply** at a given branch.
- Update/delete the details of a **Room Service** at a given branch.
- Update/delete the details of a **Financial Transaction** specific to a branch. An update of a purchasing will happen after an accountant reviewed a transaction and flagged it as reviewed.
- Update/delete the details of a **Purchasing** at a given branch. An update of a purchasing will happen after the person-in-charge has proceeded to purchase the items. An update will include time purchased, discounts, and unit price (if any).

DATA QUERIES

1. List the number, full name, working hours, position of **Employees** by a given branch sorted by name alphabetically.
2. List the details of **Supplies** by a given branch and supply name, ordered by quantity in ascending order.
3. List details of **supplies** that are used the most by a branch.
4. List the details of **Room Services** for cleaning personnel.
5. List the number, floor, and building of **Rooms** that have occupied by customers.
6. Identify the total sum of **Customer Payment** within a given period in a branch.
7. Identify the **Room Utility** cost for a monthly rental within a branch.
8. Identify the total **Room Utility** cost for all monthly rentals within a branch.
9. List all **Utility** records of a given Room and given rental number.
10. List the room number, check-in time, check-out time and type of **Rental** for the process of planning and scheduling room services and security routine.
11. List **Customer Payments**, that associates with a branch, by time and transaction type.
12. List room number, customer name, rental type, deposit, rental amount, as well as **supplied** used by the **room**.
13. List all **rentals** that will be **expired** within a given time range at a branch.
14. List all **rooms** that will be **free** within a given time range at any branch in a case the customer must be redirected to another branch.

15. Identify room number and rental type of branch **reservations** that are scheduled within a given time range.
16. List all **room services** done to a specified **room** within a branch.
17. List all **room services** done to a specified **rental** within a branch.
18. List all **room services** done by a given **employee** in a branch.
19. List all **rental check-in** that is supervised by a given **employee**.
20. List all **rental check-out** that is supervised by a given **employee**.
21. List periods that have the maximum number of cleaning service requests within a branch ordered by descending order.
22. Identify the average number of unique **customers** per week within a branch in a given time range.
23. Identify the average number of new **customers** per week within a branch in a given time range.
24. Identify which **room** has the longest rental duration from any customer with a given period.
25. Identify which periods will have the highest **utility** usages in terms of unit or cost in a branch.
26. List items to be purchased in a given on-going **purchasing** instances.
27. List **maintenance** instances within a given time range.
28. List **financial transaction** made in a branch with a given period of time.
29. List **payrolls** that are associated with a given employee.
30. Identify the total sum of money in all payrolls that associated with a given employee.

Customer

DATA REQUIREMENTS

1. BRANCH

A customer has access to the basic information of branches such as the branch's name, location, office working hours, room capacity, telephone numbers, fax number, and email address.

2. ROOM

Customers can access the total number and details of available rooms in order to select the room for booking or reservation. Moreover, customers should know room size, floor number, the building number are of which can affect room prices.

3. RESERVATION

A customer will be the person who provides reservation information. They should be able to access the data about their booking.

TRANSACTION REQUIREMENTS

DATA ENTRY

Customer does not enter the data by themselves. It is the duty of a branch manager.

DATA UPDATE/DELETION

Customer does not update/delete the data by themselves. It is the duty of a branch manager.

DATA QUERIES

1. List the details of **Rooms** in each branch.
2. List the details of a **Reservation** that a particular customer has reserved. (A customer can reserve a room and get the details of the Reservation that they have made)
3. List the details of **Branches** by a location given by a customer.
4. List the details of **Available rooms** in each branch.
5. List the **Contact** details in each branch.
6. List the **Feedback** that is submitted by the customer who gave the feedback.

System Specifications

Initial Database Size

- There are approximately 80 members of staff working in 10 branches. There is an average of 8 staff at each branch.
- There are approximately 134 rooms in all branches. Each branch has more than 10 rooms and a maximum of 15 rooms.
- There are approximately 220 customers for all branches in 1 day. Each branch has about 22 customers in 1 day.

- There are approximately 20 reservations for all branches in 1 day. Each branch has about 2 reservations in 1 day.
- There is approximately 30 payment transaction for all branches in 1 week. Each branch has about 3 payments in 1 week.
- There are approximately 500 supplies for all branches. Each branch has about 50 supplies.
- There are approximately 100 financial transactions for all branches in a week. Each branch has approximately 20 transactions in a week.

Database rate of growth

- Approximately 50 new customers will be added to the database across all branches each month. If customers did not rent the room from the last time within two years, the record will be deleted.
- Approximately 300 new rentals will be added to the database across all branches each month. The record will be deleted after 2 years after the creation of the record.
- Approximately 10 new employees join and leave the company each month. The data of employees will be deleted after 1 year after the employee leaves the apartment.

Types and average number of record searches

- Search for detail of branch - approximately 10 per day.
- Search for detail of room - approximately 50 per day (during low season), approximately 400 per day (during high season).
- Search for an employee in each branch - approximately 20 per day.
- Search for detail of customers - approximately 20 per day.
- Search for detail of rental - approximately 100 per day.

Networking and shared access requirements

All branches should be securely networked to a centralized database located at Bright House's main office in Soi Buakhao. The system should allow for 1 to 2 people concurrently accessing the system from each branch.

Performance

- During opening hours, but not during peak periods, expect less than a 1-second response for all single record searches. During peak periods, expect less than a 3-second response for each search.

- During opening hours, but not during peak periods, expect less than a 3-second response for each multiple record searches. During peak periods, expect less than a 5-second response for each search.
- During opening hours, but not during peak periods, expect less than a 1-second response for all single record each update/save. During peak periods, expect less than a 3-second response for each update/save.

Security

- The database should be password-protected.
- Each member of staff should be assigned database access privileges appropriate to a particular user view.
- A member of staff should see only the data necessary to do his or her job in a form that suits what he or she is doing.
- A client should see only their own booking data and personnel details using the Bright House apartment website.

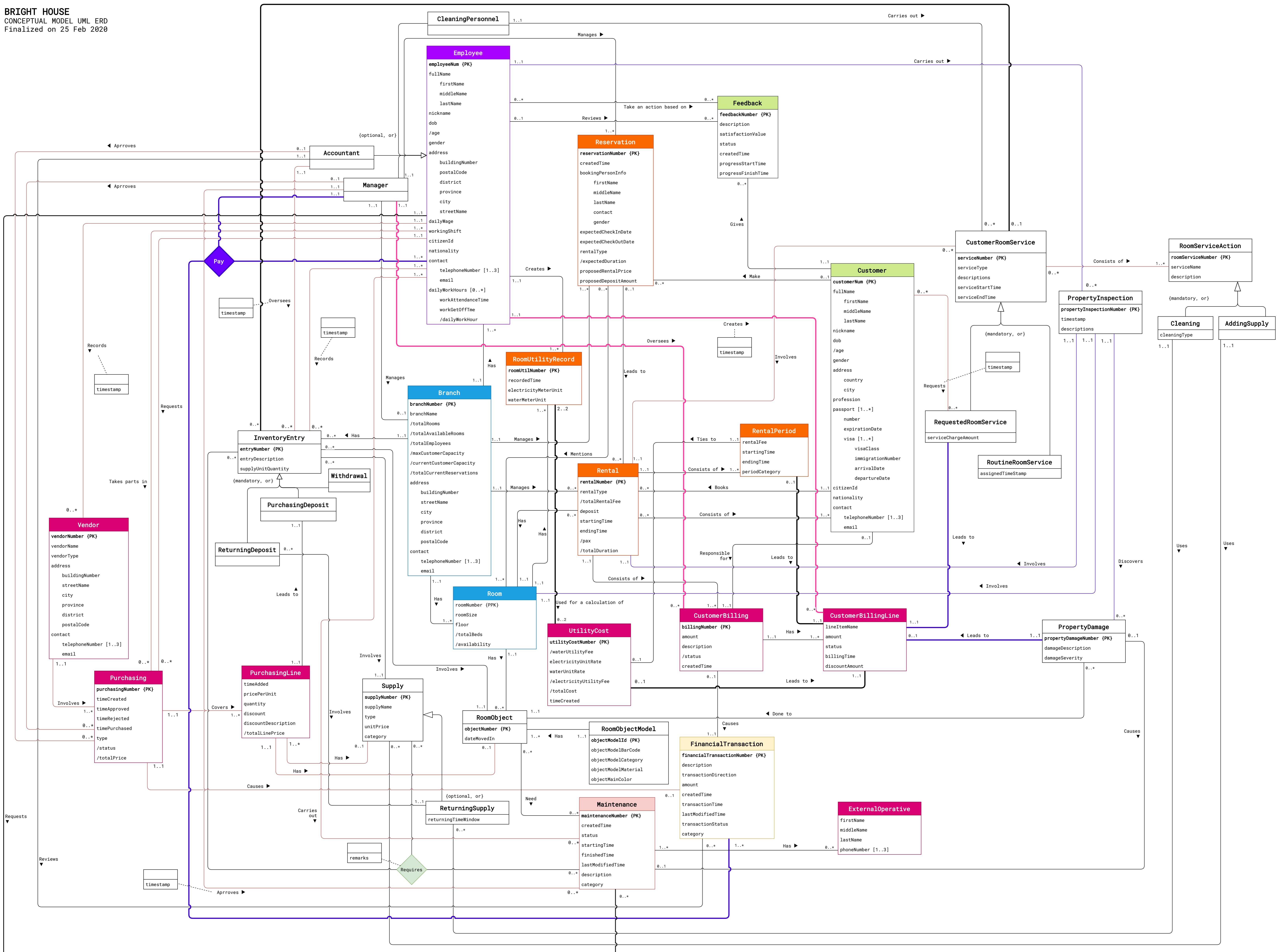
Backup and recovery

The database should be backed up daily at 6 a.m. Since Pattaya is a night tourist city, most people do not sleep at night. They will sleep in the morning. People also wake up late so most people begin their daily life at noon.

Legal issues

Bright House database holds data from staff and clients. Data privacy is a personal data must be kept legally. Legal issues must be complied with should be investigated and implemented.

Entity-Relationship Diagram



Entity type specification list

#	Entity Name	Description	Alias	Occurrences
1	Accountant	General term describing all employees who is in an accountant position in any branch of Bright House.		Each accountant can oversee records of inventory transactions. Each accountant can review or verify multiple financial transaction. Each accountant can approve multiple purchasing.
2	AddingSupply	General term describing actions of adding or refilling consumable supply during a customer room service.	RefillingAction	Adding supply is a type of room service action. Adding supply service action uses supply.
3	Branch	General term describing all branches of Bright House apartment.	Apartment	Each branch is managed by one branch manager. Each branch has to manage multiple reservations of their own. Each branch has to manage customer rentals. Each branch can have at least one room. Each branch has their own inventory entry records. Each branch must have at least one employee to operate.
4	Cleaning	General term describing actions of cleaning during a customer room service.	CleaningAction	Cleaning is a type of room service action. Cleaning service action uses returning supply.
5	CleaningPersonnel	General term describing all employees who are cleaning personnel in any branch of Bright House.		Each cleaning personnel carries out room services for customers.
6	Customer	General term describing all customers of Bright House Apartment.	Guest	Each customer requests a rental which is tied to a room. Each customer will provide the required personal information for the branch. Each customer can choose to give feedback. Customers can optionally request room services. A customer in a rental is responsible for a rental bill. Each customer may or may not be included in any rental. Each customer can request multiple rentals.
7	CustomerBilling	General term describing all billing instances that has to be paid by customers.	RentalBilling	Each bill is must be paid by a customer. Each customer billing depends on the rental that the customer has requested. Each customer bill has at least one bill line. Each customer bill is eventually lead to a financial transaction. At least one customer billing is included in a rental.
8	CustomerBillingLine	General term describing all billing lines in all customer bills.		Each customer billing line is included in a billing. Each customer billing line may be caused by a rental period. Each customer billing line may be caused by requested room service. Each customer billing line may be caused by one instance of property damage. Each customer billing line is created by an employee. Each customer billing line may be caused by a utility cost.
9	CustomerRoomService	General term describing all room service instances associated to a rental, provided by Bright House, carried out by cleaning personnel.	ApartmentRoomService	Each room service for customers is being carried out by a cleaning personnel. Each room service is consisted of at least one room service action. Each room service must associate with a rental. There are two sub-types of room service: requested room service and routine room service. Each room service may require many inventory deposits or withdrawals.
10	Employee	General term describing all staff or employees employed by Bright House Apartment. This includes any person responsible for any role in Bright House.	Staff	Each employee must have an apartment branch to work in. Every employee performs their work according to their role in the branch. Each employee can optionally carry out property inspections. Each employee may reviews feedback and take action based on it. Any employee can record utility usages, includes electricity and water utility, of a room. Each employee can carry out multiple maintenance tasks. An employee can record many inventory entries. Each employee is get paid by a branch manager which included as a financial transaction. Each employee may take part in or carry out a approved purchasing. Each employee can request for many maintenances of Bright House's belongings to take place.

#	Entity Name	Description	Alias	Occurrences
11	ExternalOperative	General term describing external personnel who involves in Bright House internal property maintenance.	Repairman	Each external operative must participate in a maintenance.
12	Feedback	General term describing the feedback from customers.	CustomerReview	Each customer can generate several feedback entries. Each action can be executed by employees based on feedback. Each feedback is reviewed by an employee.
13	FinancialTransaction	General term describing financial transactions between the customer and the Bright House Apartment		Each Financial transaction may be caused by a purchasing. Each financial transaction must be reviewed by an accountant. Many financial transactions may be caused by a payment between a manager to many employees. Each financial transaction may be caused by a customer billing.
14	InventoryEntry	General term describing transactions of supplies and objects in or out of a branch inventory.	InventoryLedgerLine	Each maintenance may require supply and additional inventory entries. Each branch has many inventory entries. Each inventory entry involves supply (a consumable). Each supply entry is recorded by an employee. Each supply entry must be overseen by an accountant. Each supply entry must be overseen by an accountant. Supply entry has 3 types which are withdrawal, purchasing deposit, and returning deposit. Each inventory entry may involve with a customer room service.
15	Maintenance	General term describing entries of detail of the maintenance done in the Bright House Apartment		Each object in each room needs maintenance. Each employee can carry out many maintenance tasks. Each maintenance may require many entries of the inventory which consists of multiple supply. Each maintenance needs to be approved by a manager before it starts. Each maintenance may have external operatives. Each maintenance may be caused by property damage. Each maintenance must be requested by an employee.
16	Manager	General term describing all manager who manage a branch.	BranchManager	Each manager can approve multiple purchasing. Each manager may approve or allow many maintenance tasks to occur. A manager pays many employees which will also involve many financial transactions. A manager may or may not manage a branch. A manager can oversee multiple customer billings. Manager is one of many available employee positions. Each manager can manage many reservations.
17	PropertyDamage	General term describing the property damage that have been recorded	RoomObjectDamage	Each property damage is discovered by a property inspection. A property damage may lead to a maintenance. Each damage is done to a room object which is a property of Bright House. A property damage may lead to a customer billing line.
18	PropertyInspection	General term describing instances of property inspection carried out by an employee at the end of a customer rental.	RoomInspection	Each property inspection is a task carried out by an employee. Each property inspection involves only one customer rental. A property inspection may lead to discoveries of property damage.
19	Purchasing	General term describing the purchase for additional supply		A purchasing covers multiple purchasing lines. Each purchasing involves only one vendor. Each purchasing may get approved by a manager. Each purchasing may get approved by an accountant.
20	PurchasingDeposit	General term describing the supply that was received from the purchasing process		Supply entry purchasing deposit type is a consequence of a purchasing line. Purchasing deposit is a type of supply entry.

#	Entity Name	Description	Alias	Occurrences
21	PurchasingLine	General term describing the supply that have been gain from the purchasing process		Each purchasing line is covered by a purchasing. Each purchasing line may include a room object. Each purchasing line may include a supply. Each purchasing line always lead to purchasing deposit.
22	Rental	General term describing the rental made by customers in any branch of Bright House Apartment	CustomerStay	Each rental consists of at least one rental period. Each rental is associated with only one apartment room. Each rental consists of at least one customer. Each rental is managed by an apartment branch. Each rental must be booked by a customer. Each rental may involve multiple room services. Each rental may have its associated reservation. Each rental must get inspected for property damages. Each rental can associate with many customer billings.
23	RentalPeriod	General term describing a smaller period of time that a rental last. In this case, rental period may has a length of a day or a month depends on the rental type.		Each rental period belongs to only one rental. Each rental period associates to a customer billing line. Each rental period may tie to a utility cost record.
24	RequestedRoomService	General term describing customer room service instances that are done by cleaning personnel on a customer request.		Each customer may request many room services. Each requested room service leads to a customer billing line. Requested room service is a sub-category of customer room service.
25	Reservation	General term describing the reservation that have been made by either an old customer or someone else.		Each reservation can be made for multiple rooms. Each reservation is managed by a manager. Each reservation is may lead to single or multiple rentals. Each reservation is may be added by a customer. If a reservation is not added by a customer, it may be added by a someone else. Each reservation mentions at least one room. Each reservation is managed by a branch.
26	ReturningDeposit	General term describing deposits for returning supply.		Each returning deposit involves with one returning supply. Returning deposit is a type of supply entry.
27	ReturningSupply	General term describing consumable that can be returned to the inventory. Similarly to its parent type, supply in this entity will be recorded in terms of types. For example, 2 bottle of identical floor wax would be represented by 1 rows.		A returning supply/consumable involved multiple returning deposits. Returning supply is a subtype of supply. Each returning supply is used by a cleaning service action.
28	Room	General term describing all rooms in Bright House Apartment.	ApartmentRoom	Each room is owned by one branch. Each room may or may not have room objects. Each room has multiple utility records. Each room gets involved in a property inspection. Each room may get involved in a reservation. Each room may have a rental associate to it.
29	RoomObject	General term describing all furniture, decorations and other non-consumables that exist in each room in each branch.		Every damaged room object will be recorded as property damage. Each room object needs multiple maintenances. Each room object may be present in a purchasing line. Each object is included in a room.
30	RoomObjectModel	General term describing models of non-consumables such as furniture and decorations in apartment.		Each object model has multiple room objects associate to it.
31	RoomServiceAction	General term describing all possible actions that can be performed by a cleaning personnel during a customer service session.		Each room service action is included in many customer room services. There are 2 categories of room service action: cleaning action and adding supply action.

#	Entity Name	Description	Alias	Occurrences
32	RoomUtilityRecord	General term describing records of room utility usage meter reading.	RoomUtilityMeterReading	Each room utility record is created by an employee. Each room utility record has to involve with only one room. Each room utility record may be used to calculate up to 2 utility cost records. Each pair of room utility records can be used to calculate a billing line.
33	RoutineRoomService	General term describing customer room service sessions that are being done routinely for each rental.		Routine room service is a sub-category of customer room service.
34	Supply	General term describing all classes or types of consumable that Bright House have ever own. For example, if all branches has total 4 bottles of identical shampoo, the supply will be counted as 1 record with amount on hand equal to 4. Consumable supply, by default, does not required to be returned such as rolls of tissue paper will be represented by this entity.	Consumable	There is another type of supply: returning supply. Each supply may be included in many purchasing lines. Each supply may involve multiple inventory entries. Each supply can be requested by a customer via adding supply room service.
35	Vendor	General term describing sellers of products.	Merchant	Each utility cost is calculated from a pair of room utility record. Each utility cost instance is tied to a rental period. Each utility cost leads to a customer billing line of a customer billing.
36	Withdrawal	General term describing the retrieval of the supply for internal purposes.		Each vendor is recorded by an employee. Each purchasing involves multiple purchases.
37	UtilityCost	General term describing records of cost of water and electricity utility of a room that is rented by customers.		Withdrawal is a type of inventory entry.

Relationship Type Association

Entity	Multiplicity	Relationship	Multiplicity	Entity
Customer	1..1	Gives	0..*	Feedback
Customer	0..1	Makes	0..*	Reservation
Customer	0..*	Requests	0..*	RequestedRoomService
Customer	0..1	Responsible for	1..1	CustomerBilling
Customer	1..1	Books	0..*	Rental
CustomerRoomService	0..*	Involves	1..1	Rental
CustomerRoomService	0..*	Consists of	1..*	RoomServiceAction
PropertyInspection	1..1	Discovers	0..*	PropertyDamage
PropertyInspection	0..1	Involves	1..1	Room
PropertyInspection	1..1	Involves	1..1	Rental
PropertyDamage	1..1	Leads to	0..1	CustomerBillingLine
PropertyDamage	0..*	Done to	1..1	RoomObject
PropertyDamage	0..1	Causes	0..1	Maintenance
CustomerBilling	0..1	Causes	1..1	FinancialTransaction
CustomerBilling	1..1	Has	1..*	CustomerBillingLine
RentalPeriod	0..1	Leads to	1..1	CustomerBillingLine
Rental	1..1	Consists of	1..*	RentalPeriod
Rental	0..*	Consists of	1..*	Customer
Rental	0..*	Has	1..1	Room
Rental	1..1	Consists of	1..*	CustomerBilling
Reservation	0..1	Leads to	0..*	Rental
Reservation	0..*	Mentions	1..*	Room
RoomUtilityRecord	2..2	Used for a calculation of	0..2	UtilityCost
UtilityCost	0..1	Leads to	1..1	CustomerBilling
RentalPeriod	1..1	Ties to	0..1	UtilityCost
Maintenance	1..*	Has	0..*	ExternalOperative
Maintenance	0..*	Requires	0..*	Supply
	0..*	Requires	0..*	InventoryEntry
RoomObject	0..*	Need	0..*	Maintenance
Room	1..1	Has	1..*	RoomUtilityRecord
Room	1..1	Has	0..*	RoomObject
Branch	1..1	Manages	1..*	Reservation
Branch	1..1	Has	1..*	Employee
Branch	1..1	Has	0..*	InventoryEntry
Branch	1..1	Has	1..*	Room

Entity	Multiplicity	Relationship	Multiplicity	Entity
Branch	1..1	Manages	0..*	Rental
Employee	1..1	Carries out	0..*	CustomerRoomService
Employee	0..*	Take an action based on	0..*	Feedback
Employee	0..1	Reviews	0..*	Feedback
Manager	1..1	Manages	1..*	Reservation
Employee	1..1	Creates	1..*	RoomUtilityRecord
Manager	1..1	Creates	0..*	CustomerBillingLine
Manager	1..1	Manages	0..1	Branch
Employee	1..*	Carries out	0..*	Maintenance
Employee	1..*	Records	0..*	InventoryEntry
Accountant	1..1	Oversees	0..*	InventoryEntry
Employee	1..1	Requests	0..*	Purchasing
Employee	1..*	Takes parts in	0..*	Purchasing
Employee	1..1	Records	0..*	Vendor
Manager	1..1	Approves	0..*	Maintenance
Manager	0..1	Approves	0..*	Purchasing
Accountant	1..1	Reviews	0..*	FinancialTransaction
Accountant	0..1	Approves	0..*	Purchasing
Manager	1..1	Pay	1..*	Employee
	1..1	Involves in	1..*	FinancialTransaction
Employee	1..*	Involves in	1..*	FinancialTransaction
Branch	1..1	Has	1..*	Employee
InventoryEntry	0..*	Involves	1..*	RoomObject
InventoryEntry	0..*	Involves	1..1	Supply
Vendor	1..1	Involves	1..*	Purchasing
CleaningPersonnel	1..1	Carries out	0..*	CustomerRoomService
Cleaning	1..1	Uses	0..*	ReturningSupply
AddingSupply	1..1	Uses	0..*	Supply
RequestRoomService	0..1	Leads to	1..1	CustomerBillingLine
ReturningDeposit	0..*	Involves	1..1	ReturningSupply
PurchasingSupply	1..1	Leads to	1..1	PurchasingDeposit
Purchasing	1..1	Cover	1..*	PurchasingLine
Purchasing	1..1	Causes	0..1	FianacialTransaction
PurchasingLine	1..*	Has	0..1	Supply
PurchasingLine	1..1	Has	0..1	RoomObject
CustomerRoomService	0..1	Requires	0..*	InventoryEntry
RoomObjectModel	1..1	Has	1..*	RoomObject
Employee	1..1	Requests	0..*	Maintenance

Data Dictionary

The list of attributes associated with each entity and relationship.

Entity Name	Attribute	Description	Data Type & Length	Attribute Domain	Nulls	Multi-valued	Derived	Primary Key
Employee	employeeNum	Uniquely identifies an employee	10-digit integer		No			Yes
	fullName	Full name of an employee			No			
	firstName	First name of an employee	30 variable characters		No			
	middleName	Middle name of an employee	30 variable characters		Yes			
	lastName	Last name of an employee	30 variable characters		No			
	nickname	Nickname of an employee	10 variable characters		Yes			
	dob	Date of Birth of an employee	Date		No			
	age	Age of an employee	10-digit integer		Yes		Yes	
	gender	Gender of an employee	1 character	M, F	Yes			
	address	Address of an employees			No			
	buildingNumber	Building number associated to the address of an employee	10 variable characters		No			
	postalCode	Postal Code associated to the address of an employee	5 characters		No			
	district	Name of the district associated to the address of an employee	40 variable characters		No			
	province	Name of the province associated to the address of an employee	40 variable characters		No			
	city	Name of the city associated to the address of an employee	40 variable characters		No			
	streetName	Name of the street associated to the address of an employee	40 variable characters		No			
	dailyWage	The total amount of wage per day for an employee in Thai Baht	4-digit integer		No			
	workingShift	Represents the day on which an employee has to attend the work, and the length in hours per day individually.			No	[1..7]		
	workingDay	Abbreviated name of day of week that represents the work day that an employee must attend the work e.g. Monday (MO), Tuesday (TU), Wednesday (WE), Thursday (TH), Friday (FR), Saturday (SA), Sunday (SU).	2 characters	MO, TU, WE, TH, FR, SA, SU	No			
	startingHour	Represents the number of hour on which an employee has to come to work before being considered to be late. Used in conjunction with starting minute.	2-digit integer	0 - 23	No			
	startingMinute	Represents the number of minute on which an employee has to come to work before being considered to be late. Used in conjunction with starting hour.	2-digit integer	0 - 29	No			
	lengthHour	Indicates the amount of time that an employee has to work in the day.	2-digit integer	1 - 24	No			
	citizenId	The citizen identification number of an employee	13 characters	00000000000 - 99999999999	No			
	nationality	The nationality of an employee	3 characters	AAA - ZZZ	No			
	contact	Contact of an employee			No			
	telephoneNumber	Telephone number of an employee (can be either mobile phone or land line)	10 variable characters	0000000000 - 9999999999	No	[1..3]		
	email	Email address of an employee.	320 variable characters		Yes			
	dailyWorkHours	Record of an employee's work hours in each day that the employee attends the work.			No	[1..*]		
	workAttendanceTime	Indicates the time on which an employee start his/her work.	Date Time		No			
	workGetOffTime	Indicates the time on which an employee end or leave his/her work.	Date Time		No			
	dailyWorkHour	Total length of work being done by an employee in hour.	2-digit integer	1 - 24	Yes		Yes	
Customer	customerNum	Uniquely identifies a customer	10-digit integer		No			Yes
	fullName	Full name of a customer			No			
	firstName	First name of a customer	30 variable characters		No			
	middleName	Middle name of a customer	30 variable characters		Yes			
	lastName	Last name of a customer	30 variable characters		No			
	nickname	Nickname of a customer	10 variable characters		Yes			
	dob	Date of Birth of a customer	Date		No			
	age	Age of a customer	10-digit integer		Yes		Yes	
	gender	Gender of a customer	1 character		Yes			
	address	Address of a customer			No			
	country	Name of the country associated to the address of a customer	40 variable characters		No			
	city	Name of the city associated to the address of a customer	40 variable characters		Yes			
	profession	Profession of a customer	40 variable characters		Yes			
	passport	The passport identification of a customer			No	[1..*]		
	number	Passport number of a customer	9 characters		Yes			
	expirationDate	Passport expiration date of a customer	Date		Yes			
	visa	The visa identification of a customer			Yes	[1..*]		
	visaClass	Visa class of a customer (e.g. TR = Tourist Visa, O-A = Coming to live as an elderly person)	6 variable characters		Yes			
	immigrationNumber	Immigration number which checks the customer information when they enter the country.	3-digit integer		Yes			
	arrivalDate	Approval date for entering the country	Date		Yes			
	departureDate	Approval date for leaving the country	Date		Yes			
	citizenId	The citizen identification number of a customer	13-digit integer		Yes			
	nationality	The nationality of a customer	40 variable characters		No			
	contact	Contact of a customer	10 variable characters		No			
	telephoneNumber	Indicates mobile phone number of a customer which includes area code and phone number.	15 variable characters		Yes	[1..3]		
	email	Email address of a customer.	320 variable characters		Yes			
Reservation	reservationNumber	Uniquely identifies a reservation	10-digit integer		No			
	createdTime	Time on which a reservation had been created.	Date Time		No			
	bookingPersonInfo	Booking information of a person.			No			
	firstName	First name of a person who reserved rooms	30 variable characters		No			
	middleName	Middle name of a person who reserved rooms	30 variable characters		Yes			
	lastName	Last name of a person who reserved rooms	30 variable characters		No			
	contact	Format-free Contact detail which can be LINE ID, email, phone number, or Facebook account name	30 variable characters		No			
	gender	Gender of a person who reserved rooms	1 character	M, F	Yes			
	expectedCheckInDate	Date on which the person is expected to check-in at the apartment	Date		No			
	expectedCheckOutDate	Date on which the person is expected to check-out from the apartment	Date		No			
	rentalType	Rental type that the person required e.g. Monthly rental (M), daily rental (D)	1 character	M, D	No			
	expectedDuration	The number of days that the rental expected to last.	3-digit integer		No		Yes	
Vendor	proposedRentalPrice	The expected cost of the rental based on the rental duration.	6-digit integer		No		Yes	
	proposedDepositAmount	The expected deposit of the rental.	4-digit integer		No		Yes	
	vendorNumber	Uniquely identifies each vendor	10-digit integer		No			Yes
	vendorName	The name of a vendor. If the vendor multiple branches, the name of a branch can also be included with the name.	30 variable characters		No			
	vendorType	Indicates the type of a vendor e.g. Convenient Store (C), Supermarket (S), Grocery (G).	1 character	C, S, G	No			
Address	address	Address of a vendor			No			
	buildingNumber	Building number associated to the address of an vendor	10 variable characters		No			

Entity Name	Attribute	Description	Data Type & Length	Attribute Domain	Nulls	Multi-valued	Derived	Primary Key
Vendor	streetName	Name of the street associated to the address of a vendor	40 variable characters		No			
	city	Name of the city associated to the address of a vendor	40 variable characters		No			
	province	Name of the province associated to the address of a vendor	40 variable characters		No			
	district	Name of the district associated to the address of a vendor	40 variable characters		No			
	postalCode	Postal Code associated to the address of a vendor	5 characters		No			
	contact	Contact of a vendor	10 variable characters		No			
	telephoneNumber	Telephone number of a vendor (can be either mobile phone or land line)	9 characters		No	[1..3]		
Feedback	email	Email address of a vendor	320 variable characters		Yes			
	feedbackNumber	Uniquely identifies each feedback	10-digit integer		No			Yes
	description	Feedback Explanation in details. It can be a issue report, praise or advise.	100 variable characters		No			
	satisfactionValue	Optional integer value that indicates feedback giver satisfaction from the scale of 0 (Worst) to 9 (Best).	1-digit integer	0 - 9	Yes			
	status	Indicates the status of the feedback. It can be reviewed (R), low priority (L), high priority (H), ignored (I).	1 character	R, L, H, I	No			
	createdTime	Time on which the feedback has been created.	Date Time		No			
	progressStartTime	Time on which the feedback has been started being worked on.	Date Time		Yes			
Purchasing	progressFinishTime	Time on which the feedback has been finished being worked on.	Date Time		Yes			
	purchasingNumber	Uniquely identifies each purchasing	10-digit integer		No			Yes
	timeCreated	Time on which the purchasing has been created	Date Time		No			
	timeApproved	Time on which the purchasing has been approved	Date Time		Yes			
	timeRejected	Time on which the purchasing has been rejected	Date Time		Yes			
	timePurchased	Time on which the purchasing has been purchased	Date Time		Yes			
	type	Indicate the type of the purchase. It can be either furniture (F), consumable resupply (R), appliance (A).	1 character	F, R, A	No			
PurchasingLine	status	Status of each purchasing	1 character	N, A, R, P	No		Yes	
	totalPrice	Total price of each purchasing	Precision 19, Scale 4 Decimal		No		Yes	
	timeAdded	Time on which the purchasing line has been added.	Date Time		No			
	pricePerUnit	Price per unit	Precision 19, Scale 4 Decimal		No			
	quantity	Quantity of each product	10-digit integer		Yes			
Supply	discount	amount of discount of a product in the line	Floating point number		Yes			
	discountDescription	description of each discount	100 variable characters		Yes			
	/totalLinePrice	Total price of each purchasing line	Precision 19, Scale 4 Decimal		No		Yes	
	supplyNumber	Uniquely identifies each supply	10-digit integer		No		Yes	
RoomObject	supplyName	Name of each supply	30 variable characters		No			
	type	type of each supply	1 character	R, N	No			
	unitPrice	price per unit of each supply	Floating point number		No			
	category	catagory of each supply	30 variable characters		No			
RoomObjectModel	objectNumber	Uniquely identifies each room object	10-digit integer		No			Yes
	dateMovedIn	Move in date	Date Time		No			
RoomObjectModel	objectModelId	Uniquely identifies each room object model	10-digit integer		No			Yes
	objectModelBarcode	Barcode of a model	13 integers		No			
Maintenance	objectModelCategory	Category of a non-consumable product model.		bed, chair, mirror, cupboard, television, air conditioner, fan, curtain, safe, bedsheets, pillow, blanket, electricKettle, vacuumCleaner, refrigerator	No			
	20 variable characters							
	objectModelMaterial	Material of a object model.	30 variable characters		No			
	objectMainColor	Main color of each model.	10 variable characters		No			
	maintenanceNumber	Uniquely identifies each maintenance	10-digit integer		No			Yes
	createdTime	Time on which the maintenance has been created.	Date Time		No			
	status	The current status of each maintenance	30 variable characters		No			
FinancialTransaction	startingTime	Time on which the maintenance has been started being worked on.	Date Time		Yes			
	finishedTime	Time on which the maintenance has finished	Date Time		Yes			
	lastModifiedTime	The lastest modify maintenance time.	Date Time		No			
	description	The description of each maintenance.	400 variable characters		No			
	category	Category of each a maintenance	30 variable characters		Yes			
Branch	financialTransactionNumber	Uniquely identifies each financial transaction	10-digit integer		No			Yes
	description	The description of each financial transaction	400 variable characters		Yes			
	transactionDirection	The direction of financial transaction e.g. In transaction, Out transaction			No			
	amount	The amount of financial transaction	Precision 19, Scale 4 Decimal		No			
	createdTime	Time on which the financial transaction has been created.	Date Time		No			
	transactionTime	The transaction time of financial transaction.	Date Time		No			
	transactionStatus	The transaction status e.g. pending, review, flag			No			
Branch	category	Category of each financial transaction			Yes			
	branchNumber	Uniquely identifies each branch	2-digit integer		No			Yes
	branchName	The name of a branch	20 variable characters		No			
	totalRooms	The total room of a branch.	2-digit integer		No		Yes	
	totalAvailableRooms	The total available room of a branch.	2-digit integer		No		Yes	
	totalEmployees	The total employee of a branch.	2-digit integer		No		Yes	
	maxCustomerCapacity	Maximum customer number of a branch.	2-digit integer		No		Yes	
	currentCustomerCapacity	Current customer number of a branch.	2-digit integer		Yes		Yes	
	totalCurrentReservations	The total current reservations number of a branch.	3-digit integer		No		Yes	
	address	Address of a branch			No			
Branch	buildingNumber	Building number associated to the address of a branch	10 variable characters		No			
	streetName	Name of the street associated to the address of a branch	5 characters		No			
	city	Name of the city associated to the address of a branch	40 variable characters		No			
	province	Name of the province associated to the address of a branch	40 variable characters		No			
	district	Name of the district associated to the address of a branch	40 variable characters		No			

Entity Name	Attribute	Description	Data Type & Length	Attribute Domain	Nulls	Multi-valued	Derived	Primary Key
Rental	postalCode	Postal Code associated to the address of a branch	40 variable characters		No			
	contact	Contact of a branch			No			
	telephoneNumber	Telephone number of a branch (can be either mobile phone or land line)	10 variable characters		No	[1..3]		
	email	Email address of a branch	320 variable characters		Yes			
	rentalNumber	Uniquely identifies each rental	6-digit integer		No			Yes
	rentalType	Type of each rental e.g. Monthly, Daily	1 character		No			
	totalRentalFee	The total rental fee of each rental	Precision 19, Scale 4 Decimal		No		Yes	
	deposit	The deposit of each rental	4-digit integer		No			
	startingTime	Time on which the rental has been started.	Date Time		No			
	endingTime	Time on which the rental has ended.	Date Time		No			
RentalPeriod	pax	The number of customer	1-digit integer		No		Yes	
	totalDuration	The total day of a rental	3-digit integer		No		Yes	
	rentalFee	Amount of rental fee associated to the period.	Precision 19, Scale 4 Decimal		No			
	startingTime	Time on which the rental period has been started	Date Time		No			
CustomerRoomService	endingTime	Time on which the rental period has ended.	Date Time		No			
	periodCategory	Category of each rental period e.g. monthly (M), or daily (D).	1 character	M, D	No			
	serviceNumber	Uniquely identifies each customer room service	6-digit integer		No			Yes
	serviceType	Type of room service that can be requested by the customer e.g. Cleaning (C), resupply (R), etc.	1 character	C, R	No			
PropertyInspection	descriptions	Details of the room service that the customer has requested	300 variable characters		Yes			
	serviceStartTime	The timestamp marking the beginning of the room service	Date Time		No			
	serviceEndTime	The timestamp marking when the room service that was request was finished	Date Time		Yes			
	propertyInspectionNumber	Uniquely identifies each property inspection	10-digit integer		No			Yes
RoomServiceAction	timestamp	The timestamp marking the inspection of each property	Date Time		No			
	descriptions	The detail of each property that was inspected.	400 variable characters		No			
	roomServiceNumber	Uniquely identifies each room service	6-digit integer		No			Yes
	serviceName	The name of the service that is about to be perform on the room	50 variable characters		No			
CustomerBilling	description	The detail of the service that is about to be perform on the room	400 variable characters		Yes			
	billingNumber	Uniquely identifies each customer billing	10-digit integer		No			Yes
	amount	The amount of customer billing	Precision 19, Scale 4 Decimal		No			
	description	The description of each customer billing	200 variable characters		Yes			
CustomerBillingLine	status	Status of each customer billing e.g. pending (PE), paid (PA), unpaid (UN), due (DU), canceled (CA).	2 characters	PE, PA, UN, DU, CA	No		Yes	
	createdTime	Time on which a customer billing had been created.	Date Time		No			
	amount	The amount of customer billing	Precision 19, Scale 4 Decimal		No			
	lineItemName	Uniquely identifies each customer billing line	10 variable characters		No			
ExternalOperative	amount	The amount of customer billing line	Precision 19, Scale 4 Decimal		No			
	status	Customer billing line status e.g.	10 variable characters		No			
	billingTime	Time on which a customer billing line had been created.	Date time		No			
	firstName	First name of a external operative	30 variable characters		No			
Room	middleName	Middle name of a external operative	30 variable characters		Yes			
	lastName	Last name of a external operative	30 variable characters		No			
	phoneNumber	Telephone number of an external operative (can be either mobile phone or land line)	10 variable characters		No	[1..3]		
	roomNumber	Within one branch, a room number uniquely identify a room.	10-digit integer		No			
RoomUtilityRecord	roomSize	The size of room e.g. Standard room (STD), Superior room (SUP).	3 characters	STD, SUP	No			
	floor	The floor of a room	1-digit integer		No			
	totalBeds	The total beds in a room	1-digit integer		No		Yes	
	availability	The availability of a room e.g. Yes (Y), No (N).	1 character	Y, N	No		Yes	
InventoryEntry	roomUtilityNumber	Uniquely identifies each room utility record	10-digit integer		No			Yes
	recordedTime	The recorded time of each room utility record	Date time		No			
	electricityMeterUnit	Electricity meter unit of a room utility record	4 digit integer		No			
	waterMeterUnit	Water meter unit of a room utility record	4 digit integer		No			
PropertyDamage	entryNumber	Uniquely identifies each inventory entry	10 digit integer		No			Yes
	entryDescription	A short description the intended usages or remarks.	100 variable characters		No			
	supplyUnitQuantity	Quantity of each supply in inventory	5 digit integer		Yes			
	propertyDamageNumber	Uniquely identifies each property damage	10-digit integer		No		Yes	
UtilityCost	damageDescription	The description of each property damage	400 variable characters		No			
	damageSeverity	The damage severity of a property damage e.g. low (L), medium (M), high (H).	10 variable characters	L, M, H	Yes			
	utilityCostNumber	Uniquely identifies each instance of utility cost	10 variable characters		No			Yes
	/waterUtilityFee	The total amount of water utility fee in to be paid.	Precision 19, Scale 4 Decimal		No		Yes	
RequestRoomService	electricityUnitRate	The rate of water cost. Baht per unit.	Precision 6, Scale 4 Decimal		No			
	waterUnitRate	The rate of electricity cost. Baht per unit.	Precision 6, Scale 4 Decimal		No			
	/electricityUtilityFee	The total amount of electricity fee in to be paid.	Precision 19, Scale 4 Decimal		No		Yes	
	/totalCost	The total utility that adds both electricity and water utility cost. A customer will have to pay at this amount.	Precision 19, Scale 4 Decimal		No		Yes	
RoutineRoomService	timeCreated	The time on which the utility cost is calculated.	Date time		No			
	serviceChargeAmount	The amount of service fee that will be charge for the room service performed.	Precision 19, Scale 4 Decimal		No			
	assignedTimeStamp	The time assign for the room to be routinely cleaned	Date Time		No			
	Cleaning	cleaningType	The type of cleaning that was perform on the room e.g. Full (F), Bed only (B), Toilet only (T).	1 character	No			
ReturningSupply	returningTimeWindow	Time on returning a supply	Date Time		No			
	ReturningDeposit							
	PurchasingDeposit							
	Withdrawal							
Accountant	Manager							
	CleaningPersonnel							
	AddingSupply							
	RequestRoomService							
RoutineRoomService	RoutineRoomService							
	Cleaning							
	ReturningSupply							
	ReturningDeposit							
UtilityCost	PurchasingDeposit							
	Withdrawal							
	Accountant							
	Manager							
CleaningPersonnel	CleaningPersonnel							
	AddingSupply							
	RequestRoomService							
	RoutineRoomService							

Entity Key List

Candidate, the primary and the alternate keys for each entity are as follows:

Entity Name	Candidate key	Alternate key	Primary key
Accountant			
AddingSupply			
Branch	branchNum		BranchNum
Cleaning			
CleaningPersonnel			
Customer	customerNum		customerNum
	citizenId	citizenId	
CustomerBilling	billingNumber		billingNumber
CustomerBillingLine			
CustomerRoomService	serviceNumber		serviceNumber
Employee	employeeNum		employeeNum
	firstName, lastName	firstName, lastName	
	firstName, lastName, dob	firstName, lastName, dob	
ExternalOperative			
Feedback	feedbackNumber		feedbackNumber
FinancialTransaction	financialTransactionNumber		financialTransactionNumber
InventoryEntry	entryNumber		entryNumber
Maintenance	maintenanceNumber		maintenanceNumber
Manager			
PropertyDamage	propertyDamageNumber		propertyDamageNumber
PropertyInspection	propertyInspectionNumber		propertyInspectionNumber
Purchasing	purchasingNumber		purchasingNumber
PurchasingDeposit			
PurchasingLine			
Rental	rentalNumber		rentalNumber
RentalPeriod			
RequestedRoomService			
Reservation	reservationNumber		reservationNumber
ReturningDeposit			
ReturningSupply			

Entity Name	Candidate key	Alternate key	Primary key
Room	roomNumber	roomNumber	
	roomNumber, floor	roomNumber, floor	
RoomObject	objectNumber		objectNumber
RoomObjectModel	objectModelId		objectModelId
	objectModelId, objectModelCategory	objectModelId, objectModelCategory	
	objectModelId, objectModelBarcode, objectModelCategory	objectModelId, objectModelBarcode, objectModelCategory	
RoomServiceAction	roomServiceNumber		roomServiceNumber
RoomUtilityRecord	roomUtilNumber		roomUtilNumber
RoutineRoomService			
Supply	supplyNumber		supplyNumber
	supplyName, supplyType	supplyName, supplyType	
Vendor	vendorNumber		vendorNumber
	vendorName, vendorType	vendorName, vendorType	
Withdrawal			
UtilityCost	utilityCostNumber		utilityCostNumber

Constraints & Business rules

CONSTRAINTS

1. Withdrawal is a type of inventory entry.
2. Each vendor is recorded by an employee.
3. Each purchasing involves multiple purchases.
4. Each utility cost leads to a customer billing line of a customer billing.
5. Each utility cost instance is tied to a rental period.
6. Each utility cost is calculated from a pair of room utility record.
7. Each supply can be requested by a customer via adding supply room service.
8. Each supply may involve multiple inventory entries.
9. Each supply may be included in many purchasing lines.
10. There is another type of supply: returning supply.
11. Routine room service is a sub-category of customer room service.
12. Each room utility record may be used to calculate up to 2 utility cost records.
13. Each room utility record has to involve with only one room
14. Each pair of room utility records can be used to calculate a billing line.
15. Each room utility record is created by an employee.
16. Each room service action is included in many customer rooms services.
17. There are 2 categories of room service action: cleaning action and adding supply action.
18. Each object model has multiple room objects associate to it.
19. Each object is included in a room.
20. Each room object may be present in a purchasing line.
21. Each room object needs multiple maintenances.
22. Every damaged room object will be recorded as property damage
23. Each room may get involved in a reservation
24. Each room gets involved in a property inspection.
25. Each room may or may not have room objects.
26. Each room may have a rental associate to it.
27. Each room is owned by one branch.
28. Each room has multiple utility records.
29. Each returning supply is used by a cleaning service action.
30. Returning supply is a subtype of supply.
31. A returning supply/consumable involved multiple returning deposits.
32. Each returning deposit involves with one returning supply.
33. Returning deposit is a type of supply entry.
34. Each reservation is managed by a branch.
35. Each reservation mentions at least one room.
36. Each reservation is may be added by a customer. If a reservation is not added by a customer, it may be added by a someoneelse.
37. Each reservation is may lead to single or multiple rentals.
38. Each reservation is managed by a manager.

39. Each reservation can be made for multiple rooms.
40. Requested room service is a sub-category of customer room service.
41. Each requested room service leads to a customer billing line.
42. Each customer may request many room services.
43. Each rental period may tie to a utility cost record.
44. Each rental period associates to a customer billing line.
45. Each rental period belongs to only one rental.
46. Each rental can associate with many customer billings.
47. Each rental may have its associated reservation.
48. Each rental must get inspected for property damages.
49. Each rental may involve multiple room services.
50. Each rental must be booked by a customer.
51. Each rental is managed by an apartment branch.
52. Each rental consists of at least one customer.
53. Each rental is associated with only one apartment room.
54. Each rental consists of at least one rental period.
55. Each purchasing line always lead to purchasing deposit.
56. Each purchasing line may include a supply.
57. Each purchasing line may include a room object.
58. Each purchasing line is covered by a purchasing.
59. Purchasing deposit is a type of supply entry
60. Supply entry purchasing deposit type is a consequence of a purchasing line.
61. Each purchasing may get approved by an accountant.
62. Each purchasing may get approved by a manager.
63. Each purchasing involves only one vendor.
64. A purchasing covers multiple purchasing lines.
65. A property inspection may lead to discoveries of property damage.
66. Each property inspection involves only one customer rental.
67. Each property inspection is a task carried out by an employee.
68. A property damage may lead to a customer billing line.
69. Each damage is done to a room object which is a property of Bright House.
70. A property damage may lead to a maintenance.
71. Each property damage is discovered by a property inspection.
72. Each manager can manage many reservations.
73. Manager is one of many available employee positions.
74. A manager may or may not manage a branch.
75. A manager can oversee multiple customer billings.
76. A manager pays many employees which will also involve many financial transactions.

77. Each manager may approve or allow many maintenance tasks to occur.
78. Each manager can approve multiple purchasing
79. Each maintenance must be requested by an employee.
80. Each maintenance may be caused by property damage.
81. Each maintenance may have external operatives.
82. Each maintenance needs to be approved by a manager before it starts.
83. Each maintenance may require many entries of the inventory which consists of multiple supply.
84. Each employee can carry out many maintenance tasks.
85. Each object in each room needs maintenance.
86. Each inventory entry may involve with a customer room service.
87. Supply entry has 3 types which are withdrawal, purchasing deposit, and returning deposit.
88. Each supply entry must be overseen by an accountant.
89. Each supply entry is recorded by an employee.
90. Each branch has many inventory entries.
91. Each inventory entry involves supply (a consumable).
92. Each maintenance may require supply and additional inventory entries.
93. Each financial transaction may be caused by a customer billing.
94. Many financial transactions may be caused by a payment between a manager to many employees.
95. Each financial transaction must be reviewed by an accountant.
96. Each Financial transaction may be caused by a purchasing.
97. Each feedback is reviewed by an employee.
98. Each action can be executed by employees based on feedback.
99. Each customer can generate several feedback entries.
100. Each external operative must participate in a maintenance.
101. Each employee can request for many maintenances of Bright House's belongings to take place.
102. Each employee may take part in or carry out a approved purchasing.
103. Each employee is get paid by a branch manager which included as a financial transaction.
104. Each employee can carry out multiple maintenance tasks.
105. An employee can record many inventory entries.
106. Any employee can record utility usages, includes electricity and water utility, of a room.
107. Each employee may review feedback and take action based on it.
108. Each employee can optionally carry out property inspections.
109. Every employee performs their work according to their role in the branch.
110. Each employee must have an apartment branch to work in.
111. Each room service may require many inventory deposits or withdrawals.

112. There are two sub-types of room service: requested room service and routine room service.
113. Each room service must associate with a rental
114. Each room service is consisted of at least one room service action.
115. Each room service for customers is being carried out by a cleaning personnel.
116. Each customer billing line may be caused by a utility cost.
117. Each customer billing line is created by an employee.
118. Each customer billing line may be caused by a rental period.
119. Each customer billing line may be caused by requested room service.
120. Each customer billing line may be caused by one instance of property damage.
121. Each customer billing line is included in a billing.
122. At least one customer billing is included in a rental.
123. Each customer bill is eventually lead to a financial transaction.
124. Each customer bill has at least one bill line.
125. Each customer billing depends on the rental that the customer has requested.
126. Each bill is must be paid by a customer.
127. Each customer can request multiple rentals.
128. Each customer may or may not be included in any rental.
129. A customer in a rental is responsible for a rental bill.
130. Customers can optionally request room services.
131. Each customer can choose to give feedback.
132. Each customer will provide the required personal information for the branch
133. Each customer requests a rental which is tied to a room.
134. Each cleaning personnel carries out room services for customers
135. Cleaning service action uses returning supply.
136. Cleaning is a type of room service action.
137. Each branch must have at least one employee to operate.
138. Each branch has their own inventory entry records.
139. Each branch can have at least one room.
140. Each branch has to manage customer rentals.
141. Each branch has to manage multiple reservations of their own.
142. Each branch is managed by one branch manager.
143. Adding supply service action uses supply.
144. Adding supply is a type of room service action.
145. Each accountant can approve multiple purchasing.
146. Each accountant can review or verify multiple financial transaction.
147. Each accountant can oversee records of inventory transactions.
148. Each maintenance is requested by an employee.

BUSINESS RULES

1. A branch must have at least one room, but a room can only exist at one branch.
2. A branch may have up to 3 telephone numbers one of which has to be a real landline telephone number of a branch.
3. Each room number is not unique to all branches.
4. A branch can manage multiple reservations that are booked by a customer who is already in the record or someone else who never visited any Bright House branch.
5. In each reservation, the full name and contact details must be recorded for additional uses such as informing the update of the reservation if any.
6. All customers will be asked to fill the guest check-in/out form for their information such as full name, nickname (optional), date of birth, gender, address, profession, and citizen ID (if any). Furthermore, for foreign customers, they will have to provide additional information such as passports and VISA.
7. To schedule apartment rooms appropriately, a booking person and an employee must come into an agreement on the room that will be used for the rental. Total fee that includes daily/monthly rate and deposit must be specified by a branch manager to a booking person.
8. Reservations can be made for multiple rooms. For example, there are some instances that a booking person wants 3 rooms for their 6 friends.
9. Some reservations may lead to multiple rentals each of which tied to one room. Therefore, if a person booked 3 rooms, there will also be 3 rentals.
10. Each branch is responsible for managing many of its rentals.
11. Customers who have stayed at one of the Bright House branches can give feedback to any employee using a form.
12. Employees can review or take an action based on the feedback from customers.
13. There must be a customer who book for a rental. In other words, if a group of customers willing to book at a Bright House branch, there must be one of those customers who books.
14. Each rental can be divided into several periods that reflect a rental type (daily or monthly rental).
15. Each rental period will be tied to a billing line of a customer bill. A customer from a respective rental must pay the bill.

16. Each rental is consisting of multiple customer billing each of which will lead to a financial transaction.
17. For a monthly rental, a branch employee record utility meters of a room before and after a customer rental period in order to calculate total utility cost.
18. Each utility cost must be paid along with rental fee of a rental period.
19. After a customer has paid the last bill before they check out, an employee will be assigned to carry out an inspection of the property in their room. If there are damages done to Bright House's property, a customer belongs to the rental must take the responsibility by paying the full amount for a new replacement. For example, if a guest is discovered making unwashable strains on a bedsheet, the guest must pay the full price of the bedsheet as compensation.
20. In order for any employee to get an item in or out of a branch inventory, they must record in a following manner:
21. For returning/non-returning consumables, each employee must specify a textual description and quantity.
22. For a room object (non-consumable), only one object is limited per entry; therefore, an entry description is required; however, the quantity number is not needed.
23. To reduce the complexity of the business, a vendor can be added by an employee as long as the vendor is genuine.
24. Each purchasing is limited to only one vendor; therefore, all lines within must originates from the same vendor.
25. After each purchase is finished, all items from all purchasing lines will be transferred to the inventory of a branch. All items will be recorded.
26. Each purchasing line can be either for consumable items (supply) or non-consumable items (room object) each of which has a different method to record specified as follows:
27. For returning/non-returning consumables, each employee must specify a textual description and quantity.
28. For a room object (non-consumable), only one object is limited per entry; therefore, an entry description is required; however, the quantity number is not needed.

The user transaction

1. Enter a new reservation in Tanachon branch.
 - o The details of the customer are held in the customer entity.
 - o The details of room reservation are held in the reservation entity.
 - o The details of Tanachon branch are held in the branch entity.
 - o We use the reservation, customer, and branch relationship to produce the required list.
2. List the room that is available on 24 Feb 2020 in each branch.
 - o The availability of the room on 24 Feb 2020 are held in the room entity.
 - o The details of each branch are held in the branch entity.
 - o We use the branch and room relationship to produce the required list.
3. List all employees name in Dolphin Sleep branch.
 - o The employee's name is held in the employee entity.
 - o The Dolphin Sleep branch details are held in the branch entity.
 - o We use the employee and branch relationship to produce the required entity.
4. List all customer billings on 20 Feb 2020 in branch Tanachon.
 - o The customer billing on 20 Feb 2020 details are held in the payment entity.
 - o The branch Tanachon details are held in the branch entity.
 - o The branch entity can pass to customer billing entity via the rental entity.
 - o We use the customer billing, rental, and branch relationship to produce the required entity.
5. Show the amount of sugar that had been bought in 22 May 2014 1.12 PM.
 - o The sugar details are held in the supply entity.
 - o The details about quantity are held in purchasing line entity.
 - o We use the supply and purchasing line relationship to produce the required entity.
6. Show the latest cleaning date of room 202 rental in branch Dolphin Sleep.
 - o The details of room 202 rental are held in the rental entity.
 - o The details of Dolphin Sleep branch are held in the branch entity.
 - o The details of the cleaning date are in the customer room service entity.
 - o We use the room, branch, and customer room service relationship to produce the required entity.
7. List all of the maintenance using external workers in the past 5 years.
 - o The details of external workers are held in external operatives' entity.
 - o The details of maintenance are held in maintenance entity.

- We use the maintenance and external operatives' relationship to produce the required entity.
8. Find the room that Mr. Peter Tarlay is staying.
- The room details are held in the room entity.
 - The customer details are held in the customer entity.
 - The room entity can pass to customer entity via rental entity.
 - We use the room, rental and customer relationship to produce the required entity.
9. Show the financial transaction of Mr. Peter Tarlay on 24 Feb 2020.
- The financial transaction details are held in financial transaction entity.
 - Customer details are held in customer entity.
 - Customer entity can pass to financial transaction entity via customer billing.
 - We use the financial transaction and customer relationship to produce the required entity.
10. List all of the customer information who reserved 302 room during 6 Oct 2020 to 14 Oct 2020.
- The customer details are held in the customer entity.
 - The reservation details are held in the reservation entity.
 - We use the customer and reservation relationship to create this required entity.
11. List all of the supply in every branch.
- The supply details are held in supply entity.
 - The branch details are held in branch entity.
 - Supply entity can pass to branch entity via inventory entity.
 - We use the supply, inventory, and branch relationship to create this required entity.
12. List details of damage and time use to maintenance product.
- The damage details are held in damage report entity.
 - The maintenance details are held in maintenance entity.
 - We use the damage report and maintenance relationship to create this required entity.

User transactions Pathway Checking

